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Excess Fertility

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The health priorities addressed in the other chapters of this collection have all been conditions that cause debility or death. Among these conditions are maternal and perinatal health problems. High fertility and close child spacing are a significant determinant of poor health of mothers and infants in the first week of life, as discussed in the chapter by Walsh and others and in the recent review of the National Research Council (NRC 1989). High fertility and close spacing also have consequences beyond the first week of life, at least up to age five, and have negative consequences beyond those immediate health consequences. They have negative consequences on the health and on the economic and social well-being of the family by diluting the resources available for each child and putting pressure on parents to work harder and save less. The balancing of the costs and benefits of fertility to the woman and, to a considerable degree, to the larger household is captured by her stated fertility preferences. High fertility may also have negative consequences for society as a whole. Fertility beyond which such negative consequences occur is deemed to be excess fertility. Such excess fertility is to be considered a health priority, not only because many of the negative effects are on health, but also because the delivery of family planning to prevent excess fertility is provided primarily through the health system and thus places claims on the system beyond those purely for health considerations.

The definition of excess fertility is, however, difficult, because some level of fertility is desirable from both the individual and the societal perspective. Excess fertility may be defined in several ways. From a health perspective, births to women who are too young or too old, who are of too high a parity, or who have pregnancies too closely spaced increase their own risks of mortality and poor health and those of their offspring. Births that fall into any of these categories could be considered excess. From a societal point of view, population growth rates above 2 percent are considered by many economists to be detrimental to development. Another way of defining excess fertility would be to consider what women themselves or their husbands report as excess fertility. The level of excess fertility differs substantially among these definitions. Very crude application of the first two definitions gives an estimated excess fertility of 14 to 25 percent of all births in the countries covered. The reports from individuals of their fertility preferences indicate excess fertility of 30 percent. Not only do levels differ according to the definition, but the location of excess fertility differs even more dramatically. Because of these very substantial differences we shall pay considerable attention to the issue of definition in this chapter.

Two important conclusions can be drawn from the analysis in this chapter. First, improved spacing and the deferment of birth until reproductive maturity is achieved are more important for improving child survival than are other high-fertility behaviors. Second, the societal economic benefits of reducing fertility must be weighed against the costs of doing so, and these costs depend on the motivation of women to control their fertility. Thus, the individual and societal measures of excess fertility are linked.

In the first part of this chapter, we document the current levels and trends of fertility in the various regions of the world. We shall then use these levels to determine the levels of excess fertility by different definitions from the point of view of society as a whole. In the next part, we document the levels of excess fertility from the individual's perspective, and then we document the costs of excess fertility. Given the great discrepancy between the measures of excess fertility, it is necessary to provide a link between the measures that will provide useful policy guidance. This link will be made in the section on the costs of fertility regulation. Although we give considerable attention to the measurement of excess fertility, in the rest of the chapter we follow the outline laid out for the other chapters in the collection: the costs of excess fertility are examined, strategies and costs of preventing excess fertility are estimated and case management is discussed, and finally funding and research priorities are identified.

The Significance of Excess Fertility

The significance of excess fertility needs to be established to determine its priority as a health issue.

Levels and Trends in Fertility in the Developing World

The levels and trends in fertility in the developing world vary greatly between and within regions. In table 16-1, we report regional averages of total fertility rates (TFR), the crude birth

rates (CBR), and rates of natural increase (RNIs) for the main regions of the world. In 1985, fertility in the developing world, whether measured by the crude birth rate or the total fertility rate, was lowest in Latin America and the Caribbean and in Asia, where rates were almost identical. Fertility was highest in Sub-Saharan Africa, where TFRs were almost twice as great as in Asia and Latin America. The Middle East and North Africa had rates closer to those in Africa than to the those in the areas of lower fertility.

The regional averages hide substantial variation. In table 16A-1 we provide levels and trends in fertility and the rate of natural increase for selected countries of the developing world.[1] These data show that in Sub-Saharan Africa, not only are growth rates quite high, often in excess of 3 percent, but in many cases they have increased substantially since the early 1960s. The reason for this is that although death rates have fallen from very high levels, crude birth rates have fallen little until very recently. Significant fertility declines have just recently been observed in Zimbabwe, Kenya, and Botswana. For Latin America and the Caribbean the pattern is different. The rate of natural increase has fallen in almost every case from 3 percent or higher to between 2 and 2.6 percent. This has been accomplished by decreases in birth rates that were so dramatic that they exceeded the great declines in death rates documented elsewhere in this collection.[2] Asia shows a different pattern with less uniformity. China, the Republic of Korea, and Thailand have had some of the most dramatic fertility declines ever recorded, the TFR falling almost 60 percent during the period, whereas Nepal has recorded no decline. Growth rates have remained constant in Bangladesh, have risen in Nepal, and have decreased substantially in China, Malaysia, the Philippines, Korea, and Sri Lanka. Although growth rates have not declined dramatically yet, TFRs have fallen substantially in Indonesia. The Middle East and North Africa display a mixed pattern as well, but on the whole fertility rates are higher than in Asia, there has been less decline, and growth rates are high. With the exception of Turkey, fertility and growth rates are lower in North Africa than in the Middle East for the countries in this sample.

Estimating Excess Fertility

This section discusses various ways of measuring excess fertility.

AGGREGATE MEASURES OF EXCESS FERTILITY. At the societal level, excessive population growth may have a number of negative effects, in particular on economic growth and on the environment. There is substantial debate on the effects of high rates of population growth on economic growth. (See the section "The Consequences of High Fertility," below, for more detail.) Sixty-five of 131 developing countries report that they perceive that their population is growing too fast (United Nations 1988).[3] Although each country has its own perception of what rate of growth is too high, a rule of thumb that was developed in The World Bank's *The World Development Report* (1984) was that a rate of natural increase in excess of 20 per 1,000, or 2 percent, was likely to be detrimental to economic development.

Even if it is agreed that a population growth rate above 2 percent is excessive, establishing a correspondence between the rate of population growth and the level of fertility is difficult because population growth reflects both fertility and mortality.[4] An alternative method of estimation is to identify excess fertility by the level of fertility that has negative health consequences. The accepted definition is that births too early (to women under eighteen), too late (to women over thirty-four), too frequently (closer than twenty-four months apart), and too many times (more than four children) are likely to be detrimental to maternal and child health.[5] The evidence on these consequences will be discussed in detail below. In the aggregate we could say that, using the rules of thumb, fertility is excessive if the rate of natural increase exceeds 2 percent, if the mother is younger than eighteen or older than thirty-four, if the births for one mother are closer than twenty-four months, and if the births for one mother exceed four.

Although it is easy to determine the extent to which the population growth exceeds 2 percent, it is quite difficult to determine how many births represent health risks. We do not know how many births are beyond the fourth parity, but if the average TFR is four, we know a substantial number of births are of fifth parity or higher.[6] We can also get very rough estimates of the percentage of births to women who are too old or too young from looking at age-specific birth rates. Although we will make rough estimates of the proportion of births that represent health risks, precise estimates are possible only from individual level data sets, because many women and births are in more than one risk category. There are, however, only three

Table 16-1. Projected Fertility and Rate of Natural Increase

	1985			2000			2015		
Region	*TFR*	*CBR*	*RNI*	*TFR*	*CBR*	*RNI*	*TFR*	*CBR*	*RNI*
World	3.4	27	17	2.9	23	14	2.6	20	1
Industrial countries	1.7	13	5	1.8	12	–3	2.0	12	1
Nonmarket economies	2.3	17	7	2.1	15	4	2.1	14	3
Latin America and the Caribbean	3.6	29	20[a]	2.5	21	14	2.2	18	7
Sub-Saharan Africa	6.4[a]	46	31[a]	5.4	40	29	4.0	32	23
Middle East and North Africa	5.6[a]	40	30[a]	4.3	32	24	3.1	26	19
Asia	3.3	27	18	2.6	21	13	2.2	17	9

a. Excess.
Source: World Bank data.

countries where individual level estimates have been made. In table 16-2, we summarize these estimates. None of the countries mentioned in the table has marriages involving very young women, but some other countries would have a much higher risk factor on this dimension. For these three countries, the risk factors differ substantially because of definitions. The proportion who are at risk because of high parity reflects the level of the TFR, being highest in Kenya and lowest in the Philippines.[7] The proportion of births beyond four can be calculated for selected countries for selected years from *The United Nations Demographic Yearbook* (United Nations 1986). These data are not generally available unless a system for registering vital statistics is in place or fertility surveys have been conducted. The available survey evidence is given in table 16-2. The United Nations (UN) data from registration of vital statistics show that the percentage of births beyond four ranges from about 2 percent in Korea to 30 percent in Egypt and Pakistan. The UN data for the Philippines shows a rate of 3 percent, whereas the survey data yields 19 percent. (See NRC 1989, p. 79, for a table showing how this proportion has declined dramatically in those countries which have had large fertility declines.) Using data from the World Fertility Surveys (WFSs), Hobcraft, writing in 1987, (cited in NRC 1989) has calculated the proportion of women with two or more births in which the preceding interval was less than two years. This proportion ranged from over 50 percent in Jordan, Costa Rica, and Colombia to about 20 percent in Senegal, Lesotho, and Korea. These last three countries show two patterns. The two African countries have long breastfeeding and postpartum abstinence to prevent close spacing of children, whereas Korea has very high levels of contraceptive use.

Therefore, we can identify excess fertility as the number of births needed to reduce the rate of natural increase to 2 percent, to reduce the TFR to four, or to eliminate births at high-risk ages.[8] Using the aggregate data in table 16-1 and data on age-specific fertility for the countries in table 16A-1, we find that there would be excess fertility of 14 percent, 16 percent, and 31 percent, respectively, by each definition.[9]

Looking at the individual countries one sees a pattern that is more mixed. In table 16A-1, the countries that have excess fertility by one definition or the other are noted. All countries of Africa are noted as having excess fertility on measures of both TFR and RNI. Excess fertility ranges from a 48 percent TFR and a 105 percent RNI in Kenya to a low of about 30 percent for both in Lesotho.[10] In Latin America and the Caribbean only four of the countries have TFRs above four, but all countries except Trinidad and Tobago have a RNI of 2 percent or greater. Brazil, Colombia, Guyana, Haiti, and Jamaica, however, have rates of 2 or 2.1 percent. Thus it is the other countries that have excess fertility of a substantial amount, ranging from over 30 percent in Paraguay to 20 to 25 percent in the Dominican Republic, Ecuador, and Venezuela. In Asia, excess fertility is greatest in Nepal and Bangladesh. India has marginal excess fertility. Malaysia and the Philippines have TFRs below four but have a RNI in excess of 2 percent. All the countries of the Middle East and North Africa in our sample except Turkey have excess fertility by both measures. The Middle East countries, however, have higher excess fertility than those in North Africa.

By using these measures for individual countries, it is possible to estimate the percentage of births in each region which fall into the excess category. These estimates are presented in table 16-3. The three measures give different estimates of the magnitude of high fertility. The TFR and the RNI indicate that about 14 to 16 percent of the births in the developing world outside China and India are excess. The data on births by age of mother indicate that about 30 percent of the births are in high-risk categories. By these measures the greatest excess fertility is in Sub-Saharan Africa, followed by the Middle East and North Africa. There is little excess in Asia and Latin America, where fertility rates have already fallen substantially, but a fifth to a quarter of births are to women under twenty or over thirty-four.

Table 16-2. Percentage of Women with Various High-Risk Factors for Another Birth
(percent)

Risk Factor	*Kenya*	*Philippines*	*Zimbabwe*
Too young[a]	1.4	3.6	4.4
Too old[b]	36.2	35.8	33.6
Too many births[c]	61.5	42.4	40.1
Births too soon[d]	48.3	32.3	29.6
Any risk factor	—	79.7	69.7

— Not available.

Note: World Bank estimates for TFR: Kenya, 7.7; Philippines, 3.9; Zimbabwe, 5.4.

a. Under eighteen in Kenya and Zimbabwe, under twenty in the Philippines.

b. Thirty-five and older.

c. Four or more births in Kenya and the Philippines, five or more in Zimbabwe.

d. Birth in the preceding twenty-four months in Kenya; open birth interval of less than fifteen months in the Philippines; less than fifteen months potpartum and not pregnant in Zimbabwe.

Source: Kenya and Zimbabwe, DHS reports. Philippines, Casterline 1990.

EXCESS FERTILITY AS REPORTED BY INDIVIDUALS. The usefulness of parents' stated fertility preferences has been questioned for many years and is still questioned by many. One argument is that parents tend to rationalize their actual fertility and thus are unlikely to report that they want fewer children than they already have. This may be true. Nonetheless, in survey after survey in recent years, many women have reported lower desired than actual fertility or that their last birth was unwanted.[11] Even more report that they want no more children. In addition, many who do want more children want to wait a significant period before the birth of their next child. Evidence of this kind can be used to get a first approximation of excess fertility. In table 16-4 we give the number of children desired by women according to surveys conducted in the late 1970s and early 1980s. We also report the actual TFR and the TFR that would have prevailed if preferences were realized or if all unwanted births had not occurred.[12]

Several observations emerge from the various data. Family size preferences and the proportion of families who want no

Table 16-3. Excess Fertility, Measured by National Demographic Data
(millions)

Region	*Births in women under 20 and over 34*		*TFR > 4*		*RNI > 20*	
	Percent	*Number*	*Percent*	*Number*	*Percent*	*Number*
Latin America	20	2,473,000	1	86	11	1,034,000
Sub-Saharan Africa	34	3,337,000	42	4,474,000	41	4,329,000
Middle East and North Africa	39	3,421,000	22	2,663,000	25	2,938,000
Asia[a]	26	3,686,000	9	1,409,000	7	1,138,000
Total[a]	31	12,917,000	14	8,632,000	16	9,439,000
Excess births[a] (millions)	12.9	12,900,000	8.6	8,600,000	9.4	9,400,000
Total births for countries covered (millions)	42	42,300,000	59.0	59,000,000	59.0	59,000,000

a. Excluding China and India. In 1985–90, there were 113 million births in the developing world on average annually and 65 million outside India and China.

Source: Authors' calculations from World Bank data.

more children vary greatly from place to place. In Sub-Saharan Africa fewer women say they want no more children, and the desired TFR (6.7 or 6.4) in table 16-4 is very close to the actual TFR (6.9). Even so, there are differences among countries, particularly among younger women. Ghana and Lesotho report substantially lower desired fertility among the youngest women. In Latin America, actual (4.7) and desired (3.7 or 3.8) family sizes are much lower than in Africa, but excess fertility is greater. In Asia, desired (3.7 or 3.3) and actual (4.7) TFRs are very close to those in Latin America and the Caribbean. The Middle East and North Africa have the most varied pattern among countries, actual and desired fertility being very low in Turkey and very high in the Republic of Yemen. On average the TFR is 6.2 for this region, and desired fertility ranges between 5.6 and 4.7. Therefore, using the conservative desired fertility measures cited above, we find that in a perfect contraceptive world, fertility could be lowered by at least one child per woman in Latin America and Asia, by between 0.2 and 0.5 children in Sub-Saharan Africa, and by between 0.6 and 1.5 in the Middle East and North Africa.

In table 16-5 we report the proportion of women who want no more children according to World Fertility Surveys (funded by UNEP and USAID) and more recent Demographic and Health Surveys (DHS funded by USAID). We also give the proportion who wish to postpone their next birth among those who do want more children. In every case in which there are data from two points in time, the proportion who want no more children has increased over the period. Kenya, where the proportion wanting no more children increased from sixteen to forty-nine, is the most dramatic example.

In table 16-6 we sum the individual measure of excess fertility by region. This estimate is obtained by taking the percentage difference between the actual TFR and the desired number of children and adding any births reported as unwanted and weighting it by the number of births in that country in a recent year. For the countries covered, 30 percent of the births are considered excess by the individual women themselves. This proportion exceeds 30 percent in every region except Sub-Saharan Africa. Overall, in the countries covered there were 11.6 million excess births in the average year in the late 1980s: 5 million in Asia outside China and India, 4 million in the Middle East and North Africa, and 2 million in Latin America. If these countries were representative of the entire developing world except China, which is a special case, there were 27 million excess births a year by the individual women's definition.[13]

The figures above, however, probably underestimate excess fertility for several reasons: first, as mentioned earlier, women are somewhat reluctant to report desired fertility below actual; second, fertility preferences are declining in many cases faster than actual fertility, as indicated by the fact that the proportion of women wanting no more children is increasing;[14] third, many women wish to space their births;[15] and fourth, to the extent that fertility preferences themselves reflect the cost of contraception these preferences would be reduced by increased access.

Another way of estimating excess fertility is to measure what fertility would be if contraception were perfect in all women who wish to stop childbearing or postpone their next birth. This is a much more difficult measure to obtain because of the rarer data on spacing and the need to run population projections with different usage levels.

A possible way of analyzing the extent of unwanted fertility is through model populations. In figure 16-1 we plot the relationship between the mortality level and the proportion of women who want no more children. Forty percent of the women in the countries with a crude death rate of ten or below want no more children, with the exception of Paraguay, where only a third want no more. The pattern is less uniform for the high-mortality countries. Twenty percent or less of the women in all the Sub-Saharan countries want no more children.[16] This also applies to Yemen, where 19 percent want no more. In most non-African high-mortality countries 30 to 40 percent of the women want no more children. Thus three model country types would be needed: high-mortality African countries and probably also high-mortality Middle Eastern countries, high-

Table 16-4. Preferred Family Size and Total Fertility Rates in Relation to Desired Family Size

Country	Preferred family size			Total fertility rate		
	Women 15–19	Women 45–49	All women	Usual TFR (no birth deleted)	Desired family size exceeded and birth deleted	Desired family size exceeded or last birth unwanted and birth deleted
Africa						
Benin	7.2	8.0	7.6	7.3	7.3	6.9
Cameroon	6.5	8.6	8.0	6.4	6.1	6.1
Côte d'Ivoire	7.5	9.6	8.4	7.2	7.2	7.0
Ghana	5.2	7.3	6.0	6.1	6.0	5.6
Kenya	6.6	8.7	7.2	7.9	7.6	6.9
Lesotho	5.6	7.3	6.0	6.0	5.6	5.3
Mauritania	8.3	9.4	8.8	7.5	7.1	6.8
Senegal	8.3	8.4	8.3	7.1	6.9	6.7
Sudan (North)	5.4	6.5	6.4	5.6	5.0	4.8
Latin America and the Caribbean						
Colombia	2.7	5.7	4.0	4.6	3.4	2.6
Costa Rica	3.5	6.1	4.7	3.5	3.0	2.6
Dominican Republic	3.4	6.0	4.7	5.2	3.8	3.0
Ecuador	3.1	5.6	4.1	5.2	4.1	3.1
Guyana	3.4	5.9	4.6	4.4	3.8	2.8
Haiti	2.8	4.3	3.6	5.6	4.3	2.8
Jamaica	3.3	4.8	4.1	4.4	3.4	2.3
Mexico	3.8	5.8	4.4	5.7	4.5	3.6
Panama	3.4	5.1	4.3	4.2	3.9	3.4
Paraguay	3.7	7.1	5.2	5.0	4.5	4.2
Peru	3.1	4.6	3.8	5.3	3.5	2.6
Trinidad and Tobago	3.2	4.8	3.8	3.2	2.5	2.4
Asia						
Bangladesh	3.7	5.0	4.1	5.4	4.6	3.1
Indonesia	3.3	5.4	4.2	4.3	4.0	3.6
Korea, Republic of	2.7	3.8	3.1	3.9	2.8	2.5
Malaysia	3.9	4.5	4.3	4.5	3.3	3.1
Nepal	3.6	4.3	3.9	6.1	5.4	4.5
Philippines	3.0	5.6	4.3	5.1	4.1	3.6
Sri Lanka	2.6	4.8	3.7	3.4	2.9	2.2
Thailand	2.9	4.4	3.6	4.3	3.2	2.6
Middle East and North Africa						
Egypt	4.2	4.7	4.1	5.0	3.6	3.1
Jordan	4.9	7.5	6.2	7.0	6.0	5.1
Morocco	4.3	6.6	4.9	5.5	4.4	3.7
Pakistan	4.0	4.5	4.2	6.0	4.3	3.9
Syria	5.0	7.1	6.1	7.4	6.3	5.6
Tunisia	3.7	4.4	4.1	5.5	4.1	3.6
Turkey	2.8	3.1	3.0	3.8	cc	2.4
Yemen, Rep. of	4.5	6.9	5.5	8.9	8.2	7.4

Note: Preferred Family size based on direct question; TFR based on synthetic cohort estimates of desired stopping points.
Source: Lightbourne 1987.

mortality Asian and Latin American countries, and low-mortality countries. Three artificial countries have been created to represent these types of countries; high-mortality Sub-Saharan countries, Libana; high-mortality Latin American or Asian countries, Banglapal; and low-mortality countries of Asia and Latin America, Colexico.

The excess fertility in these three model countries of a million population is given in table 16-7. The assumptions underlying these models are fairly straightforward. Three population types were developed of 1 million population each in 1990. They all had age structures, age-specific fertility and mortality rates, and patterns of marriage, breastfeeding, and contraceptive use specific to real countries of a general type. The number of births per year with current contraceptive use was projected for 1990 and 2000 as a base case. Then two alternative projections were made. In the first, all women who

Table 16-5. Currently Married Women Who Want No More Children or Who Wish to Postpone Children
(percent)

Country	Want no more		Wish to postpone[a]		DHS Year
	WFS	DHS	WFS/CPS	DHS	
Africa					
Benin	8	—	55	—	1982
Botswana	—	33	—	55	1988
Burundi	—	24	—	76	1987
Cameroon	8	—	—	—	1978
Côte d'Ivoire	4	—	38	—	1980
Ghana	12	23	—	70	1978/1988[b]
Kenya	16	49	—	68	1978/1989[b]
Lesotho	14	—	—	—	1977
Liberia	—	17	—	48	1986
Mali	—	17	—	50	1987
Mauritania	11	—	—	—	1981
Morocco	42	48	—	53	1987
Nigeria (Ondo State)	—	23	—	58	1986
Senegal	6	19	—	—	1986
Sudan	15	—	—	—	1978
Togo	—	25	—	71	1988
Tunisia	48	57	—	64	1978/1989[b]
Zimbabwe	—	33	—	61	1988
Latin America and the Caribbean					
Bolivia	—	72	—	48	1989
Brazil[c]	—	60	—	64	1986
Colombia	61	69	—	64	1976/1986[b]
Costa Rica	52	—	77	—	1976
Dominican Republic	52	63	—	51	1975/1986[b]
Ecuador	55	65	—	65	1979/1987[b]
El Salvador	—	63	—	68	1985
Guatemala	—	47	—	68	1987
Guyana	54	—	—	—	—
Haiti	42	—	—	—	—
Jamaica	48	—	—	—	—
Mexico	56	65	—	33[d]	1976/1987[b]
Panama	63	—	—	—	—
Paraguay	32	—	68	—	1979
Peru	61	70	—	60	
Trinidad and Tobago	46	55	—	55	1977/1987[b]
Venezuela	55	—	—	—	—
Asia					
Bangladesh	30	—	72	—	1976
Indonesia	40	51	—	73	1976/1987[b]
Korea, Republic of	74	—	36	—	1974
Malaysia	46	—	36	—	1974
Nepal	30	—	—	—	1976
Philippines	54	—	—	—	1978
Sri Lanka	62	65	—	60	1987
Thailand	61	66	—	61	1987
Middle East and North Africa					
Egypt	54	61	—	51	1988
Jordan	42	—	—	—	1976
Pakistan	43	—	—	—	1975
Syrian Arab Rep.	38	7.1	6.1	7.4	1978
Yemen, Rep. of	19	6.9	5.5	8.9	1979

— Not available.

a. Percentage of women who wish to postpone children for two or more years among those who want more children.

b. WFS/DHS.

c. Does not include currently pregnant women. Those who wish to postpone is defined as the percentage of women who prefer to wait one or more years among those who want more children.

d. Does not include currently pregnant women.

Source: WFS/DHS Surveys.

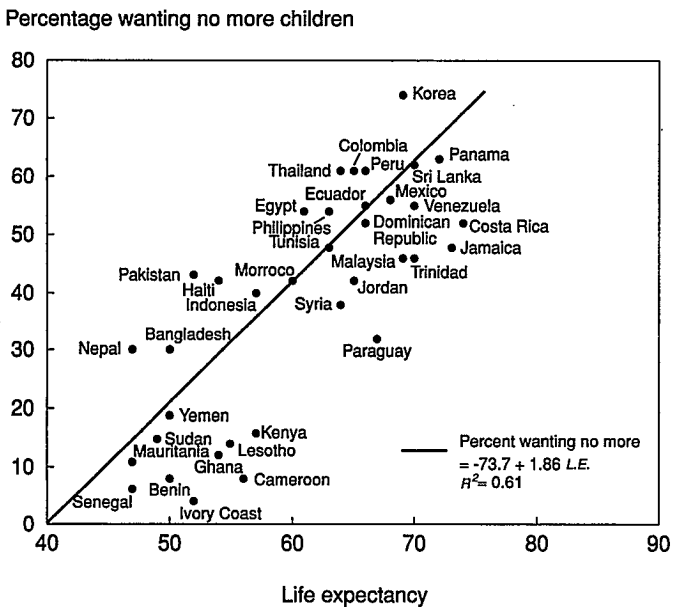
Table 16-6. Total Excess Fertility, Measured from Individual Responses

Region	*Excess over desired fertility (number)*	*Excess of TFS (percent)*
Latin America and the Caribbean	2,015,000	37
Sub-Saharan Africa	467,000	9
Middle East and North Africa	4,088,000	35
Asia[a]	5,062,000	31
Total excess births	11,632,000	30
Total excess births among births covered	38,971,000	n.a.

n.a. Not applicable.
a. Excluding India and China.
Source: Author.

claimed that they wanted no more children were assumed to be using perfect contraception.[17] The second alternative assumed that, in addition to those who wish to limit fertility, one-half of those women who wish to space their next birth are using perfect contraception.[18] It is surprising that by this measure high-mortality African countries have somewhat higher excess fertility than the high-mortality non-African countries. The reason for this is that current contraceptive use in Libana is much lower than in Banglapal. If spacing demand for contraception is included, Libana and Colexico have almost 40 percent excess fertility and Banglapal 26 percent. The relative importance of unmet need for contraception for spacing and for limiting, however, shows that limiting is less important than spacing in the high-mortality countries.

Figure 16-1. Relationship between Life Expectancy and Proportion of Women Wanting No More Children



Source: Authors' calculations.

ABORTION AS AN INDICATION OF EXCESS FERTILITY. The most extreme statement that a woman can make about excess fertility is to seek an abortion. It was because of the high incidence of complications from illegal abortion that the family planning movement began in the United States and many countries of Latin America. Because the data are of such poor quality, measures of the extent to which actual births exceed desired births cannot be derived from estimating the magnitude of abortion. The data are sufficient to give an indication of the extent to which current programs delivering contraception have been insufficient for controlling fertility to levels desired by women. (This issue is also treated under the section on case management.) The worldwide estimate of the number of abortions is between 40 million and 60 million (Henshaw 1987). It is estimated that at least 14 million occur in China and 11 million in the countries of the former U.S.S.R. Other industrial countries contributed about 4.5 million abortions. Estimates of abortion in developing countries are much less precise because abortions are more likely to be illegal there than in industrial countries. In developing countries, abortion appears to be highest in Latin America and Asia and lowest in Sub-Saharan Africa, where, as indicated above, desired family sizes are much greater. There is evidence that there are substantial differences in the incidence of abortion in the countries of Africa and that such incidence is increasing.

The Consequences of High Fertility

The consequences of high fertility are many, ranging from health consequences for mother and child to consequences for economic development.

HEALTH CONSEQUENCES OF HIGH FERTILITY. The health consequences of high fertility for mother and newborns are discussed in another chapter of this collection. In this chapter, we will discuss the health consequences beyond the first week of life. There is little debate in the literature that mortality of neonatal and postneonatal infants, and of children is positively correlated with women giving birth at too young an age, too old an age, too closely together or too many times. There is substantial debate about whether increased contraception will improve survival rates (Trussell and Pebley 1984; Bongaarts, Mauldin, and Phillips 1987, 1988; Potter 1988; Trussell 1988).[19] In this section, we will first examine the evidence of an association between high fertility and infant and child mortality. We will then discuss upper and lower limits on the costs of the deaths that may be averted by reduced fertility.

The hypothesized effects of high fertility on the survival of offspring arise from both biological and socioeconomic and behavioral factors. The biological factors arise most noticeably in the period immediately after birth and are assumed to explain why both very early and very late childbearing are detrimental to children as well as why close spacing may be problematic. High parity and close spacing are also believed to

Table 16-7. Excess Fertility for Three Model Countries

Scenario	1990		2000	
	Births	Excess (percent)	Births	Excess (percent)
Libana—High-mortality African or Middle Eastern country				
1. Current conception prevalence rate (CPR)	54,010	n.a.	74,810	n.a.
2. All who want no more children (using contraception)	46,470	n.a.	64,090	n.a.
3. Line 2 plus half of spacers	33,975	n.a.	46,655	n.a.
4. Excess: lines 1–2	7,540	14	10,720	14
5. Excess: lines 1–3	20,035	38	28,155	38
Banglapal—High-mortality Latin American or Asian country				
1. Current contraception prevalence rate (CPR)	46,540	n.a.	62,400	n.a.
2. All who want no more children (using contraception)	42,900	n.a.	57,450	n.a.
3. Line 2 plus half of spacers	34,635	n.a.	46,260	n.a.
4. Excess: lines 1–2	3,640	8	4,950	14
5. Excess: lines 1–3	11,905	26	16,140	26
Colexico—Low-mortality Asian or Latin American country				
1. Current contraception prevalence rate (CPR)	33,565	n.a.	43,031	n.a.
2. All who want no more children (using contraception)	26,397	n.a.	33,766	n.a.
3. Line 2 plus half of spacers	20,740	n.a.	26,434	n.a.
4. Excess: lines 1–2	7,168	21	9,265	22
5. Excess: lines 1–3	12,825	38	16,597	39

n.a. Not applicable.

Note: Calculated using target models with constant levels of proximate determinants of fertility, except contraceptive use. Current contraceptive prevalence was estimate to calculate number of births. The effectiveness was the level currently observed with the existing method mix. Assumes that all women who want no more children and half of those who wish to space children use perfectly effective contraceptives.

Source: Authors.

have the effect of diluting the household resources of maternal time and attention as well as family economic resources. Therefore, we should expect different patterns of effects depending on the age of the child as well as on the environment.

Data from the World Fertility Survey has been extensively analyzed by Hobcraft, McDonald, and Rutstein (1983, 1985) to show the relationships between childbearing patterns and the survival of offspring. In table 16-8 we show the average of thirty-five developing countries of the percentage increase in death rates from various reference groups for various categories of births. These estimated effects have been controlled for maternal age, spacing, parity, sex of the child, and the education of the household and thus cannot be attributed to different fertility patterns of women of different educational groups. (Detailed estimates for each country in the study are reported in tables 16A-2 through 16A-5.)

The effects of birth order generally come to mind when the effects of high fertility are mentioned. These effects are nonmonotonic and nonuniform across age groups. The first year of life has the highest risk for first births. The risk of dying for first births is 80 percent higher than for second and third births in the neonatal period and 60 percent higher in the postneonatal period. The fourth through sixth births do not show elevated mortality in the first year of life but do have 20 to 30 percent higher mortality in the second through fourth years. Births beyond six have 20 to 30 percent higher mortality at all ages. These patterns do vary substantially from country to country. Fourth through sixth births tend to be more disadvantaged in Latin America and the Caribbean than elsewhere. Births at parity seven or more are less disadvantaged in Asia and the Middle East than elsewhere, but even there, there are exceptions and the mortality of these high-parity births is more than 60 percent higher in Yemen and the Philippines than that for children of second or third parity.

Because of the much higher mortality of first births than any other group, the reduction of fertility through the reduction of higher-order births will not necessarily reduce infant mortality. This is so because a larger percentage of births will then be first births. We have found no conceptual resolution of this apparent paradox (Bongaarts 1988 and Trussell 1988).

The effects of maternal age are also nonmonotonic. The mortality of children of mothers under twenty is 30 to 60 percent higher than that of children whose mothers are twenty-five through thirty-four. Other evidence suggests that for children of women under eighteen these risks are even greater. The risks also differ between regions and are somewhat less elevated in Africa than elsewhere. Even there, there are countries, such as Tunisia, where the mortality risks of the neonates of these young mothers are greater than for the neonates of older mothers. These high risks persist until the child reaches two. The different patterns of risk for very young mothers reflect in part the selectivity of women who bear children at these young ages, which may not be completely captured by the control for education. Mortality risks are also higher for the children of women over thirty-four, but again this varies by region, being greatest in the Americas, less in Africa, and much less in Asia. Postponing the births of women until they reach the age of twenty and reducing the births after

the age of thirty-four could possibly make important contributions to reducing mortality in a number of countries, all else being equal, but until more is known about who has children at these ages and the behaviors that affect their survival chances, it is difficult to judge the magnitude of effects.

It has been hypothesized that close spacing of children is detrimental to their health for two reasons. First, the biological effect on the mother of close spacing of children leads to depletion of her health and her ability to nurture and bring to term a baby of normal weight and her ability to breastfeed that baby adequately.[20] The second factor is the competition for household resources such as the mother's time and attention and the household's economic resources. From the analysis in table 16-8, it is clear that having a birth in the twenty-four months prior to the birth of the studied child raises substantially the child's risk of death. If that previous child survived, mortality of the subsequent child is increased by between 50 and 90 percent, depending on the age group under consideration. These relative risks show more consistency than those for parity and maternal age, especially for infants. There are, however, substantial differences between countries. The relative risks in North Africa and the Middle East seem to be particularly high because of close spacing. The elevation in mortality is much more dramatic if a previous child died, but this does not necessarily so much reflect the effect of the short birth interval as the high clustering of deaths within households. Close spacing of births after the birth of a child also show an important correlation with higher mortality of toddlers and young children. One or more live births in the twelve months after a birth raises toddler mortality by about 130 percent and child mortality by 40 percent (tables 16A-1 through 16A-5).

Thus, the effects of spacing on child survival are both stronger and more consistent across countries than are the other effects of high fertility (Hobcraft, McDonald and Rutstein 1985; NRC 1989). For this reason, to get a rough estimate of the effect of family planning on child survival, we will concentrate on the effect of spacing on mortality. These estimates are tentative at best. We will estimate the effect of one year of contraceptive protection. Assuming an average of three months of natural protection from conception following a birth and nine-month gestation, it would take only twelve months of contraception protection to extend the birth interval to two years. In table 16-9 we summarize for a sample of countries the number of deaths averted in the first five years of a child's life from 1,000 years of contraceptive protection. The first estimates of deaths averted, method 1, are arrived at by comparing actual mortality of those children where there was no living birth in the preceding twenty-four months with the mortality of children when there was one surviving child.[21] The second estimate (method 2), which is generally smaller, is based on the Hobcraft and others (1985) estimates that control for age, parity, education, and spacing simultaneously. The low costs per death averted through the family planning of one year are estimated on the basis of 100 percent effective-

Table 16-8. Percentage by Which Mortality Rates of Births in Various Categories Exceed Those of Reference Group

	Births in previous 24 months[a]			*Parity*[b]			*Mother's age*[c]		
Child	*One alive*	*One dead*	*Two or more*	*4–6*	*7 or more*	*1*	*20 or less*	*20–24*	*35 or more*
Neonatal (0–1 month)									
Africa	69	278	289	1	27	114	18	0	18
Asia	82	259	362	–12	0	98	37	6	3
Latin America	53	319	209	15	44	40	37	12	27
Developing world	70	290	250	0	20	80	30	10	20
Postneonatal (1–12 months)									
Africa	65	261	233	7	27	49	38	15	0
Asia	100	215	384	2	31	70	32	6	–3
Latin America	99	256	203	3	43	62	65	27	7
Developing world	90	240	240	0	30	60	40	20	0
Toddler (1–2 years)									
Africa	19	97	62	17	14	–1	43	15	–4
Asia	83	145	81	25	31	5	44	–1	–7
Latin America	27	62	99	23	45	–8	98	46	11
Developing world	40	100	80	20	30	0	60	20	0
Child (2–5 years)									
Africa	48	67	38	18	18	–5	35	10	12
Asia	42	67	124	29	17	–12	52	16	22
Latin America	59	47	23	35	42	0	25	3	–15
Developing world	50	60	60	30	30	–6	40	10	10

a. Reference category is no birth.
b. Reference category is parity of two or three.
c. Reference category is age 25–34.
Source: Derived from Hobcraft, McDonald, and Rutstein, 1985.

ness and $7.70[22] costs per couple-year protection.[23] Because each year of couple protection does not result in a prevented birth, these figures are then adjusted for the average annual births per woman of childbearing age in the country under consideration. The high cost estimate assumes $18.00 per couple-year of protection.[24] These are then converted into disability-adjusted days of life gained.

There are substantial differences in the costs per death averted and the costs per disability-adjusted life-year gained. Not surprisingly, the lowest costs are in the highest mortality countries in the group, Pakistan and Bangladesh. More surprisingly, Egypt, which has a life expectancy at least five years above Pakistan, has similar costs, and Kenya, with life expectancy 3.5 years less than Egypt, has costs 50 percent higher. Diarrheal diseases may be an important factor in explaining these different patterns, because close child spacing may be linked to early weaning and higher mortality risks.

In summation, increased spacing of births probably represents the most important way to reduce mortality through family planning. Elimination of births at the youngest age groups is probably the second most important factor in reducing infant and child mortality. High parity and births to women over thirty-four have an effect that is less well established.

SOCIAL AND ECONOMIC COSTS OF EXCESS FERTILITY. Population growth affects economic development through its effects on savings and investment, technological change, changes in efficiency, and returns (increasing or diminishing) to scale.[25] In addition, population growth affects the resource base through resource depletion and pollution. The precise relationship between any one of these and population growth has yet to be firmly established and depends on current levels of population density, resource endowment, and the rate of population growth as well as on myriad policies from property rights in resources to agricultural subsidies (Kelley 1988; *The World Development Report* 1984; and NRC 1986 for comprehensive reviews).

The National Research Council concludes, "On balance, we reach the qualitative conclusion that slower population growth would be beneficial to economic development of developing countries" (NRC 1986, p. 90). The 1984 *World Development Report* concluded, "In short, policies to reduce population growth can make an important contribution to development (especially in the long run), but their beneficial effects will be greatly diminished if they are not supported by the right macroeconomic and sectoral policies. At the same time, failure to address the population problem will itself reduce the set of macroeconomic and sectoral policies that are possible, and permanently foreclose some long run development options" (WDR 1984, p. 105).

The costs of excess fertility, like its measurement, can be viewed by the family or society. The costs of children are primarily borne by the family. Therefore, the family's report of what is the desirable family size would incorporate the family's judgment of the desirable expenditure on children. The costs to the family of excess fertility would be measured by the costs of the marginal child to the family. Unfortunately, due to both methodological and data problems, the measurement of the costs of a child is rarely available for developing countries.[26] In addition to the costs of food, clothing, medical care, schooling, and housing, children in the family affect the amount of time a mother devotes to child care. These costs are borne by a number of adjustments in the household. Expenditure per child is reduced with increasing numbers, resulting in many cases of poor health in the children (the excess child and its siblings) and reduced school participation of all children. In addition to reduced expenditure per child, high fertility also results in efforts to increase family income.[27] The increase may come about through child labor or through added labor of the parents. An interesting body of evidence is accumulating on the higher labor participation of men in households with larger numbers of children. Finally, the adjustment to higher unwanted fertility can be made by reducing the savings of the household. (See King 1987 and Cochrane, Kozel, and Alderman 1990 for reviews of these issues.) The bottom line is that it is impossible to document the negative effects of high fertility on every dimension or every country. Thus there is not one cost of a child that can then be used to evaluate the savings from averting a birth for the individual household.[28] Therefore, it must be left to the household to establish its own evaluation

Table 16-9. Infant and Child Deaths Averted by 1,000 Couple-Years of Protection through Child Spacing and Associated Costs, Selected Countries

	Deaths averted		*Cost per DALY saved (1988 dollars)*			
			Actual[a]		*Adjusted*[b]	
Country	*Actual*[a]	*Adjusted*[b]	*Low cost*	*High cost*	*Low cost*	*High cost*
Pakistan	85	63	405/41	944/33	544/19	1,268/44
Mexico	40	34	1,532/53	3,570/123	1,794/62	4,189/144
Bangladesh	96	125	445/15	1,037/36	341/12	795/27
Philippines	40	38	1,667/58	3,907/135	1,764/61	4,110/142
Kenya	61	64	784/27	1,827/63	746/26	1,738/60
Egypt	111	131	483/17	1,125/39	413/14	962/33

a. Actual differences in mortality rates for births with and without a birth within previous twenthy-four months. Other method uses adjusted rates.
b. Estimates controlled for the education, and parity of the mother.
Source: Author.

of the costs and benefits of children. These evaluations are reflected in their stated fertility preferences. The fact that at the family level the costs exceed the benefits in many cases is revealed by the evidence cited above that 30 percent of births are in excess of stated family size preferences.

The evidence above refers to the effect of an added child on the family. If that child is unwanted, the negative effects, particularly for the child, are probably much more severe even though they are less well documented. Some work has been done on this for the industrial world as part of the justification for publicly subsidized family planning programs. For example, women denied abortion in Prague were followed up for a period of twenty years. Forty-five percent of these mothers were dissatisfied with their child's development compared with 21 percent among controls. The children themselves perceived more problems in life and more disappointments in life, love, and mental health (David 1986). Other data on how parents treat unwanted children have been documented by Shorter (1976), Ware (1976), and Scrimshaw (1978 and 1983). Evidence of infanticide, abandonment, neglect, and the selective provision of food and medical care to children has been drawn from historical and contemporary data from all geographic regions. Further evidence of the effect of unwanted children comes from a recent study in Ethiopia. It was reported that women whose births were described as unwanted were least likely to seek antenatal care (Kwast and others 1985).

The unwanted fertility of the unmarried woman is even more costly for both the mother and the potential child. Women lose out on educational and employment investments and are forced to choose between abortions (safe or unsafe), fostering out or adoption of children, and raising the child without economic support from the father. Little or no economic analysis has been done of the economic costs of fertility outside marriage in the developing world. The medical costs of unsafe abortion are discussed later in the chapter.

Society also bears some costs as a result of the birth of a child. The most obvious costs are those for education and health. If the state also takes on responsibility for food, shelter, safe water, and so on, through subsidies or public provision, the costs are commensurately higher. In the late 1950s and early 1960s efforts were made to calculate the savings from a birth averted. These most frequently took the form of estimating the consumption by children and adults and the earnings of an average adult and discounting the hypothesized streams of consumption and production. These efforts are reviewed by Ohlin (1967). Since any period of production is preceded by a period of consumption, these estimates were highly sensitive to the discount rate. Enke (1960) used rates of 10, 15, and 20 percent for a country like India and found the value of a birth averted was 3.8, 2.6, and 2.1 times the per capita annual income, respectively. Ohlin estimates that the value of a birth averted would be zero at a 4 percent discount rate, but twice per capita income at 6 percent. Alternative methodology was employed by Demeny (1965), who projected income using a macroeconomic model with different levels of fertility. He estimates that "gains from preventing a birth is of the order of magnitude of two per capita income" (Demeny 1965 cited in Ohlin 1967, p. 116).

More recent work has been less heroic and has focused only on public expenditure saved by preventing a birth.[29] Nortman and Lewis (1986) focused on the savings to the Mexican social security system from each peso spent on family planning. They documented that the cost per pregnancy per mother was 36,000 pesos and the cost of care for a child in the first year of life was 34,000 pesos.[30] In calculating a cost-benefit ratio, they also included the benefits of preventing incomplete abortions, which then had to be treated. The cost-benefit ratio was calculated to be nine pesos saved for pesos spent on family planning. For Indonesia, Chao and others (1985) analyzed the savings from expenditure averted for education and health by preventing a birth. A study by Kiranandana and others (1984) for Thailand estimated the savings in lower expenditure on

Table 16-10. Savings per Birth Averted in Three Types of Countries
(1987 U.S. dollars)

Expenditure	*5 percent discount*	*10 percent discount*
Libana—high-mortality African country		
Primary education	160[a]	84
Secondary education	147[b]	57
Health	129[c]	60
Total	436	201
Banglapal—high-mortality non-African country		
Primary education	160[d]	84
Secondary education	193[d]	74
Health	129[c]	60
Total	482	218
Colexico—low-mortality developing country		
Primary education	508[e]	354
Secondary education	492[f]	273
Health	564[g]	281
Total	1,564	908

a. Assumes universal six years of school. Capital costs at lowest 30 percentile for World Bank primary school projects. Buildings last thirty years. Recurrent cost 13 percent of average poor country per capita income.

b. Assumes 16 percent attend six years of secondary school. Capital costs at lowest 30 percentile of World Bank secondary school projects. Buildings last thirty years. Recurrent costs per year are twice those in primary education.

c. Assumes $6 per capita (as in China and Sri Lanka). Life expectancy is fifty-one years.

d. Assumptions as in note b., but 21 percent of children have six years of secondary education.

e. Universal six years of primary school. Capital costs at median for World Bank projects. Recurrent costs $100 p.a.

f. Assumes forty-five percent secondary enrollment. Capital costs at median for World Bank projects. School life thirty years. Recurrent costs twice those in primary education.

g. Assumes $28 per year for public expenditures per capita. Life expectancy is sixty-four years.

Source: World Bank estimates.

education, health care, housing and infrastructure, and social services. As long as programs are completely voluntary the benefits of a wanted child to the parents need not be included in the calculations for obvious reasons.

In table 16-10 we report the total savings and the savings per birth averted in education and health for the three model countries if all the unwanted births are averted.[31] The savings per birth averted are dramatically different between the high- and low-mortality countries but fairly similar for the two high-mortality countries. The rate of discount also makes a substantial difference in the savings. In a later section the savings per birth averted will be compared with the costs per birth averted.

Reducing Excess Fertility

The most direct strategy for reducing excess fertility is family planning, but delayed marriage, prolonged breastfeeding and abortion have significant effects as well.

Elements of Preventive Strategies

Strategies to prevent excess fertility have been very widely discussed in the literature. It is now accepted that general socioeconomic development leads to a lowering of fertility and therefore any programs aimed at fertility control will ensure the most rapid results if undertaken as a component of broader development efforts. A strategy for preventing excess fertility would have to be based on a careful analysis and appreciation of the proximate determinants of fertility in any given country or community and the relative value or relative contribution of each determinant within the system at any given point in time. Bongaarts (1978) has stated the following as the main determinants of fertility in any community:

- The patterns of marriage and consequently exposure to pregnancy
- Breastfeeding practices
- Abortions
- Contraception or direct fertility regulations activities

These proximate variables directly affect fertility. Socioeconomic factors, access to family planning, and economic opportunities, as well as legislation, affect fertility through these proximate determinants. Education is the most pervasive and best-documented factor affecting fertility through these multiple channels (Cochrane 1979; Cochrane and Zachariah 1983; United Nations 1988).

In many developing countries marriage patterns are varied and not easy to define. In traditional societies, women are generally expected to marry early and remain in marriage; their period of exposure to childbearing is thus very long. In many parts of Africa, for example, young women marry as early as age fifteen or younger—among some groups as early as onset of menarche—and remain married either to the same person or another person until they stop childbearing naturally.[32] Widowhood is not a bar to remarriage, and polygamy ensures that women do not remain without partners for too long. Thus in most parts of Africa most fertile women are exposed to the possibility of childbearing throughout their reproductive life, except for periods of postpartum abstinence, which may be quite long in some traditional societies.

It is difficult to change behavior as basic as the initiation of sexual activity and marriage, but age of marriage does rise systematically with certain aspects of economic development. Developmental actions are taking place today which influence these types of marriage and which can be considered among possible strategies for decreasing fertility in many communities. Among these are general education and paid employment away from home. General education, particularly of girls, helps them to postpone getting married until they are in the later teens or early twenties. By postponing marriage they have less exposure to pregnancy and may have fewer children, if premarital fertility does not increase. Legislation may also have some effect on the age of marriage, but it must be accompanied by general reform of women's rights and enforcement mechanisms (Duza and Baldwin 1974).

Cultural taboos, such as a woman's leaving the husband's family after she has a baby and staying with her own family until the child can walk, or a woman's not having contact with her husband until the child has grown its milk teeth, are stipulations which ensured that children were spaced at intervals of three or more years. These taboos are breaking down with modernization and as husband and wife stay together in nuclear families in urban situations. In such situations, there is a clear need to replace the lost cultural taboos with technology to ensure child spacing.

Breastfeeding is considered the most important natural contraceptive. For breastfeeding to be a useful contraceptive on a community basis, it has to be prolonged and given on demand with the child being at the nipple whenever he or she wants, even at night. It is believed that the suckling at the nipple produces a nervous stimulus which then triggers the hypothalamus and pituitary axis to produce the necessary hormones which prevent ovulation. Therefore, efforts to promote breastfeeding must be considered an important contribution to efforts to help with the reduction of excess fertility. Recent guidelines indicate that breastfeeding is a highly reliable method of contraception until the child reaches six months of age, supplementary feeding is introduced, or menses returns. Under these circumstances breastfeeding is 98 percent effective. (See Consensus Statement on the Use of Breastfeeding as a Family Planning Method, *Lancet* 1988.) If any one of these events occurs, other forms of contraception should be introduced. Breastfeeding beyond any of these points will lower the probabilities of conception, but the degree of that reduction varies greatly from one woman to another. Thus, although prolonged breastfeeding, beyond six months, can suppress fertility for society as a whole, it is an unreliable individual contraceptive. During the course of development and with the increase in education, the practice of breastfeeding to maximize its antinatal effects tends to decrease. To counter this, it

Table 16-11. Appropriateness of Contraceptive Method, by Stage in Reproductive Life Cycle

Method	Before first birth (delay)	After first birth (spacing)	Completion of family
Oral contraceptive	Most appropriate	Appropriate	Inappropriate
Injectable hormone	Appropriate	Most appropriate	Least appropriate
Implant	Appropriate	Appropriate	Most appropriate
IUD	Inappropriate	Most appropriate	Appropriate
Condom	Most appropriate	Least appropriate	Inappropriate
Vaginal spermicide	Appropriate	Appropriate	Inappropriate
Diaphragm/cap	Appropriate	Appropriate	Inappropriate
Periodic abstinence	Appropriate	Appropriate	Inappropriate
Sterilization	Inappropriate	Inappropriate	Most appropriate

Note: Menstrual regulation and abortion are backups throughout reproductive life cycle.
Source: Hutchings and Sanders 1985.

is necessary to make family planning more available and to provide for the promotion of breastfeeding where possible (Huffman and Combest 1988; Green 1989; and Labbok and McDonald 1990 in the supplement to volume 31 [1990] of the *International Journal of Gynecology and Obstetrics*).[33]

The attitudes and practices of health personnel, particularly those attending delivery, can have an important effect on the establishment and continuation of breastfeeding and on appropriate weaning behavior. These practices are important as health interventions which have an externality of preventing pregnancy. It is impossible, however, to determine the cost-effectiveness of such interventions in reducing excess fertility.

Family planning programs depend on the availability and the acceptance of modern contraception. The programs themselves need to create demand as well as provide services. Demand creation can be divided into two types: indirect and direct. Indirect demand creation depends generally on social and economic development, issues within the domain of development planning generally and national social mobilization. Among specific efforts in this domain are activities that improve general education of the people and especially those which emphasize women's education, women's mobilization, and the improvement in the status of women through various activities, be these activities developed as direct projects for family planning programs or activities developed from other programs but relating to the improvement in the status of women or improvement of their economic opportunities. Such programs can indirectly lead women to seek and accept more readily assistance to control their fertility. Their effect can be strengthened when accompanied by special messages or information and communications activities aimed at highlighting awareness of the women about the importance of fertility regulation for their lives. In education generally, opportunities need to be taken to emphasize the relation between population and resources and population and the environment. Population dynamics need to be a part of every school program in developing countries at the present time. Girls and young women must also learn at an early age the consequences of high fertility for their own health and welfare and that of their children.

Direct demand creation is that incorporated in information, education, and communication (IEC) programs which provide information specific to family size preferences or family planning and contraception techniques and services. This can take many forms, from mass media campaigns to a series of smaller, more directed efforts. All available methods of communication may be used from a variety of ministries and agencies, ministries of health, youth, women's affairs, defense, industry, and agriculture, to name a few. All these need to go hand in hand with programs for the distribution of contraceptive supplies.

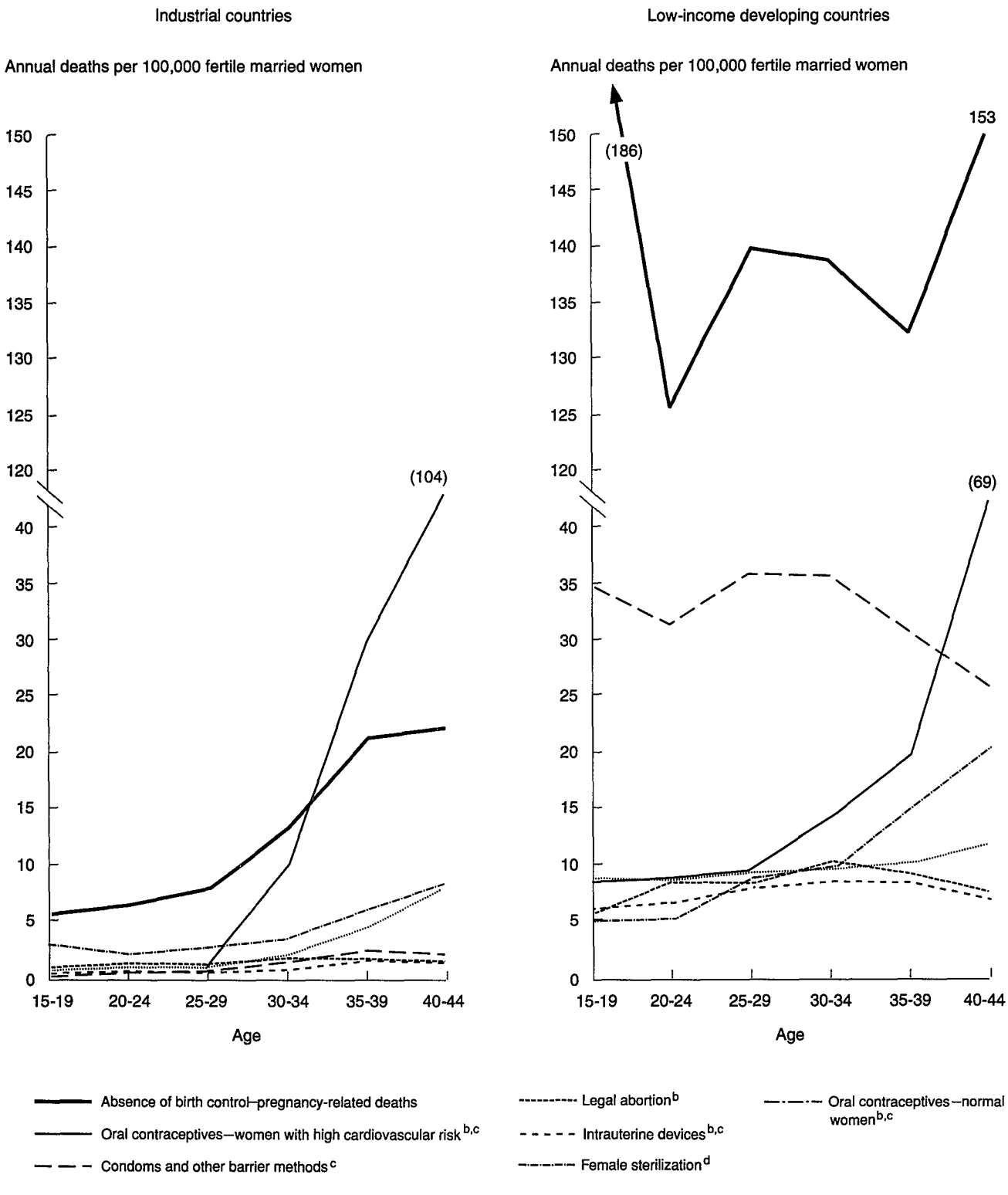
The delivery of services can take diverse forms. In many environments they have been most effective as part of maternal and child health programs. In other environments vertical or single function programs have proven most successful. The

Table 16-12. First-Year Failure Rates of Birth Control Methods

Method	Lowest observed failure rate[a]	Failure rate in typical users[b]
Chance (no method of birth control)	70	70
Tubal ligation	0.04	0.04
Vasectomy	0.15	0.15
Injectable progestin	0.25	0.25
Combined birth control pills	0.5	2
Progestin-only pill	1	2.5
IUD	1.5	4
Condom	2	10
Diaphragm (with spermicide)	2	13
Cervical cap	2	13
Foam, creams, jellies and vaginal suppositories	3–5	15
Coitus interruptus	16	23
Fertility awareness techniques (basal body temperature, mucus method, calendar, "rhythm," and douche)	2–20	20–30

a. Number pregnant by end of year among 100 women who start out the year using a given method and who use it correctly and consistently.
b. Number pregnant by end of year among 100 typical users who start out the year using a given method.
Source: CDC 1983.

Figure 16-2. Estimated Annual Deaths Resulting from Pregnancy, Abortion, and Contraceptive Use, by Age of Woman



Note: Maternal death estimates assume lower use-effectiveness rates in developing countries for all methods except the IUD.

a. Countries with per capita incomes less than $410 (U.S. dollars) and with average maternal mortality rates of about 350 deaths per 100,000 live births.

b. Method-related deaths.

c. Pregnancy-related deaths.

d. Procedure-related deaths, a one-time risk. Data that reflect deaths per 100,000 procedures rather than per 100,000 women overstate relative risks over time compared with other methods.

Source: Population Crisis Committee 1985, adapted from Potts, Speidel, and Kassel 1977.

Table 16-13. Relative Cost of Birth Control Methods

Method	Costs in initial year (U.S. dollars)	Subsequent product cost, per year (U.S. dollars)	Relative cost per CYP in initial year[c] (percent)	Relative cost per CYP amortized over average lifetime of method[a] (percent)
Oral contraceptive	2.17	2.17	100	100
Injectable hormone	3.51	3.51	162	162
Implant	16.23	n.a.	748	212
IUD	3.45	n.a.	159	42
Condom	3.88	3.88	179	179
Vaginal spermicide	5.76	5.76	265	265
Diaphragm/cap	4.75	0[b]	219	77
Female sterilization	8.91	n.a.	411	59
Male sterilization	6.68	n.a.	308	44
Menstrual regulation/abortion	4.45	n.a.	205	n.a.

n.a. Not applicable.
a. Percentages are based on estimated couple of years protection (CYP) initial year costs and are relative to cost of oral contraceptives.
b. In actual practice, spermicide use would add to the yearly cost.
c. Couple years of contraceptive protection.
Source: Hutchings and Sanders 1985.

one thing that has been learned is that there is no uniquely defined best delivery mode. Important though such clinic-based programs are, their outreach may be rather limited, especially in communities where the health services themselves are fairly restricted in their outreach. In such a situation there is a need to build outreach programs such as social marketing or community-based programs which ensure that the users themselves are closely involved with the family planning programs. Irrespective of the form of delivery system, there is a need to have a medical service with trained staff in what may be termed clinical contraception, such as the insertion of intrauterine devices (IUDs) or terminal methods such as vasectomy and tubectomy. Such a service provides for referral, backup, and training of the staff of other programs.

Primary prevention of excess fertility is thus based on a strategy of general social development with equity, in particular when such development targets women. Direct population education in communicating also helps, as does specific IEC for men and women of childbearing age. Family planning services providing information and contraceptive services at affordable prices help to ensure that the population is able to control its fertility. There are, however, other factors that inhibit that ability that need attention, from the empowerment of men and women to information on the real side effects of high fertility and contraceptive risks. The role of abortion in preventing excess fertility is more controversial and will be discussed later.

Costs and Efficacy of Family Planning

A wide variety of family planning methods is now available. They differ in their effectiveness and side effects as well as their costs (Holck and Bathija 1988; cited in WHO 1988). In table 16-11 we summarize appropriateness of various contraceptives to different phases of the reproductive life of a woman. In table 16-12 we summarize the failure rates for most modern methods except the most recently developed implants.[34] In figure 16-2 we summarize the mortality risks from various methods. It is important to note how the relative risks between contraception and childbearing differ between developing and industrial countries. It is less easy to summarize the morbidity and other side effects of various methods. Most methods have some actual or perceived negative side effects. These effects and the importance attached to them differ greatly from one woman or couple to the next. It is also true that some methods have positive side effects, from reducing anemia (oral contraceptives) to prevention of sexually transmitted diseases to the reduction of the risk of some cancers (Lee, Peterson, and Chu 1990). Thus, programs that offer a wide mix of methods are able to attract a larger number of women than programs with a narrower range of methods. It is also clear that side effects of contraceptives, particularly oral contraceptives, differ according to a woman's age. This is another reason to have a program that has a wide method mix. Family planning methods vary substantially in commodity costs and personnel and infrastructure costs. The costs of various methods are too specific to be reviewed in detail here (see table 16-13 for the supply costs of various methods and those costs in relation to the cost of oral contraceptives). Of greater relevance are the program costs of serving a family planning user or preventing a birth. Reviews of program costs per user or per birth averted were compiled in preparation for the 1984 World Population Conference (Bulatao 1985 for a review and analysis of these costs). The costs include or should include the entire costs of promoting family planning use and of commodities, personnel, equipment, and facilities for the program. These cost estimates are in fact often simply derived by dividing expenditure in any given year by the number of users. Detailed cost analyses to give precise estimates are fairly rare. (Analyses by Barnum [1983] and Chernichovsky and others [1989] are exceptions. See Serageldin and others 1983 for a review of the issues in

cost-benefit and cost-effectiveness analysis and Cochrane, Hammer, Janowitz, and Kenney 1990 for a review of newer cost estimates.)

For the purpose of this analysis the costs per user in the study by Bulatao (1985) and the costs per birth averted in the study by Cochrane and Zachariah (1983) will be used. Both of these are dependent on earlier work by Speidel (1983). The costs as collected refer to 1980, but they have been inflated to 1987 in table 16-14.[35] If economies of scale exist in the program, the average costs have probably dropped since 1980.[36] The costs per birth averted are related to the fertility preference of the women in the society. Regression analysis shows that the cost per birth averted drops by $66 for a one-child difference between the actual and desired TFR (table 16-4). As shown in figure 16-3, the cost per birth averted also decreases with an increase in the proportion who want no more children ($4.6 per 1 percent increase in the number wanting no more children).[37] Therefore, for the three hypothetical countries we can predict the costs of a birth averted by first determining the average life expectancy (fifty-one years for model countries Libana and Banglapal and sixty-four years for Colexico) and predicting the percentage wanting no more children (figure 16-1) and then projecting costs per birth averted from the equation in figure 16-3. One adjustment that must be made is that on average the countries with lower mortality have higher proportions of women who want no more children than do the primarily African countries. Best estimates indicated approximately 20, 30, and 45 percent of the women want no more children in the three models, respectively. The equation in figure 16-3 implies the costs per birth averted of $259, $213, and $144, respectively, in the three countries.[38] Comparing these costs with the savings of births averted in table 16-10, one finds that at the 5 percent discount rate, the costs of a birth averted is justified on the basis of economic savings to the government alone in all three models. At the 10 percent rate of discount, the costs of a birth averted would be fully justified in Colexico, marginally justified in Banglapal, and unjustified in Libana[39].

There are several caveats to be made with respect to the findings above: (a) the costs and savings are based on hypothetical country types, and actual estimates would have to be made in real circumstances; (b) the conclusions above apply only to the economic benefits of family planning, and the health benefits, which are substantial, as shown above, would be additional; and (c) the extent to which access to contraception would in fact alter family size preferences is yet to be established. To the extent that such an effect exists, the cost functions are incorrectly specified.

Technology and Future Changes

All existing contraceptives have some negative side effects or inconvenience; few methods allow male control or responsibility for the method, and some methods are unacceptable to certain religious groups. Thus technological development is needed for contraceptives. In addition there is continued uncertainty about the most effective and efficient delivery systems for family planning in different environments. We will briefly review changes that are currently on the horizon.

Many contraceptive technologies are currently being developed that may be useful eventually. The most promising for the 1990s is the implant. This provides highly effective contraception for up to five years with few side effects except irregular menstrual periods. It is, however, relatively expensive and requires skill in its implantation and even more skill in its removal.[40] Thus it is intensive in training and personnel at the beginning and end of use. Some research is under way on developing a biodegradable sheath which would eliminate the necessity of removal. A once-a-month injectable contraceptive, Cyclofem, is nearing commercial production and would eliminate the problem of irregular menstrual periods that occur with longer-term, hormonal methods. Other contraceptive methods being developed have less chance for immediate breakthrough because they are in earlier stages. The male pill is being developed in China under a cooperative program with the Rockefeller Foundation. Vaginal rings are also being developed, and the new RU486 provides some promise for future use. The Population Council, Family Health International, the Ford Foundation, the National Institutes of Health in the United States, the Rockefeller Foundation, and the Human Reproduction Programme (HRP) in WHO are the main actors in coordinating research on contraceptive technology. (See NRC 1990 for a review of the evaluation of contraceptive research and development.)

Despite the efforts of these organizations, the low level of funding for contraceptive development for low-income countries is a serious problem because private enterprise, which is a significant source of technological change, is not interested in developing contraceptives for that market. Three factors explain this lack of interest: (a) because many techniques that need to be developed for poor countries must, of necessity, be very low cost and low dosage, they will offer low profits; (b) because most contraceptive research is done in industrial countries and must be approved for use there to be profitable, the research is skewed toward contraceptives that reflect the relative risks of using contraceptives and the maternal risks in those countries (see figure 16-2); and (c) product liability laws are so stringent in many countries like the United States that new products face too many potential liability costs even if a product is developed and is sold. An example of how these risks distort research is the recent development of the contraceptive sponge in the industrial world. This method is too expensive, too inconvenient, and has too high a failure rate for poor countries, but it has very few possibilities of side effects for which a company could be sued (Population Crisis Committee 1985).

An important question to be addressed in the area of contraceptive technology in the next decade is the interaction of various methods and acquired immunodeficiency syndrome (AIDS). The condom serves both to prevent births and reduce the probability of contracting AIDS. For other methods the linkage between the spread of the disease and the use of the

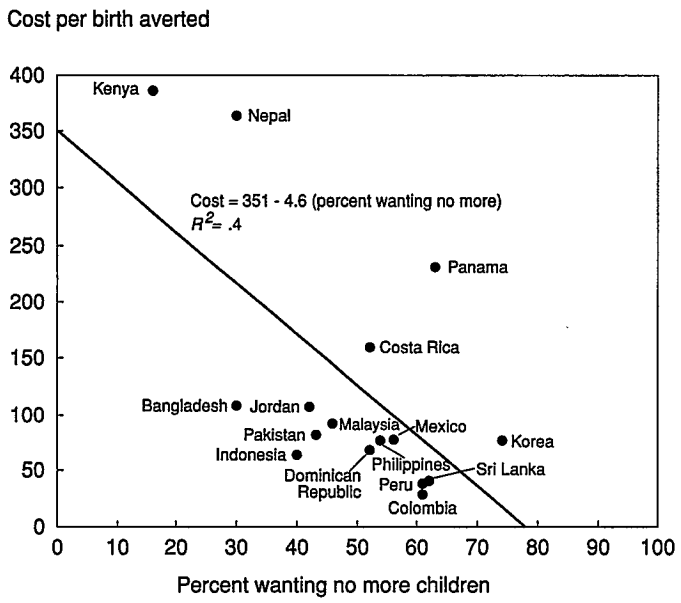
Table 16-14. Costs of Averting a Birth through Family Planning
(1987 U.S. dollars)

Country	Cost per user	Cost per averted birth	
		Low	High
Bangladesh	29	102	109
Colombia	7	21	29
Costa Rica	22	71	160
Dominican Republic	17	50	69
Indonesia	12	49	64
Jordan	31	88	108
Kenya	100	350	386
Korea, Rep. of	12	53	77
Malaysia	21	69	92
Mexico	22	59	78
Nepal	80	330	364
Pakistan	15	77	81
Panama	36	136	231
Peru	10	34	38
Philippines	20	63	77
Sri Lanka	8	31	41

Source: Converted from 1980 figures in table 9 of Cochrane and Zachariah 1983, using standard indices of the Priorities Project.

methods is unclear and needs to be researched. All surgical methods require much close attention to cleaning of instruments and equipment when the AIDS virus is at all prevalent in society. This covers implants, sterilization, abortion, and IUD insertions. In addition, injections must be more carefully monitored to be sure that needles are not reused or are properly sterilized. The Human Reproduction Programme is sponsoring the development of a small, cheap vial-needle combination that is impossible to reuse for delivery of Cyclofem. Research is also needed on how various contraceptives affect the risk of contracting the human immunodeficiency virus or developing the disease by either changing sexual behavior, increasing the receptivity to the virus, or stimulating the development of the disease. Through HRP the World Health Organization is sponsoring some research in this area and has issued guidelines. These risks must be set against the risk of the more rapid onset of the disease that is stimulated by pregnancy and the transmission of the disease to the infant during pregnancy or delivery.

Figure 16-3. Relationship between Costs per Birth Averted and Percent Wanting No More Children



Source: Authors' calculations.

In the area of the management of the delivery system, attention is now being focused on two important aspects: improvement of service quality (Jain 1989; Bruce 1990), and developing delivery models in Sub-Saharan Africa, where demand for family planning is weaker and more oriented toward spacing births than stopping them and the health infrastructure is very weak. Other themes that are receiving considerable attention are the necessity of having an appropriate monitoring and evaluation system, the movement away from one-method programs (India), the appropriate role of the private sector (Indonesia), and the appropriate mix of family planning delivery and promotion (issues involving the ministries of health, ministries of information and education, and other important ministries and coordinating bodies in population and family planning). The commitment of the medical profession as well as national leaders to the delivery of family planning for health, equity, and economic considerations is also of crucial importance to the success of a delivery system. There exist serious shortcomings of actual practice over the best practice in family planning delivery, but it is also true that despite excellent synthesis work done by the National Academy of Science in its 1987 review by Lapham and Simmons and the Johns Hopkins University Population Reports there is still an enormous amount that needs to be done to clarify what the best practice is in different environments.

Reasonable Delivery Systems for Model Countries

In the two hypothetical high-mortality countries the lack of health infrastructure is a fundamental underlying constraint. In addition in Libana demand for contraception is less than in Banglapal. In both models it is necessary to develop the health delivery system. It is also essential to target efforts in family planning, but in the second model the targets can be broader. Providing condoms, pills, and other barrier methods through health centers and pharmacies and perhaps social marketing may be desirable and effective in urban areas. Sterilizations and IUD insertions should be done in district hospitals everywhere, but in Banglapal they may also be done in clinics if they have adequate staff and if staff members are available to handle side effects. Sterilization camps, particularly for vasectomies, may also be cost-effective, but politically sensitive. Injections can be done on a mobile team if a reliable system of delivery can be maintained to make regular trips. This latter function may be better carried out by a nongovernmental organization if the

government logistics are weak. Such programs need to be backed up by information, education and communications programs that can advise on location of service and appropriate use and contraindications. This is particularly important where contraception use is low, because fear of side effects can seriously undermine the development of a program if there exists no referral agency to handle them.

In Colexico all the above can be used, but delivery of IUDs, sterilization, and injection can be done more routinely at lower levels of service because of higher demand and better health infrastructure. It is probably also essential to have either explicit policies on legal abortion or IEC on the dangers of abortion and medical facilities for treating incomplete abortions. This is likely to be more serious in Colexico because the much stronger demand to restrict fertility will lead to abortion in more cases of contraceptive failure.

Case Management: Unwanted Pregnancies

For pregnant women who want no more children or who wish to postpone the timing of a birth, the choice is between carrying the pregnancy to term or seeking an abortion. The type of costs of an unwanted pregnancy include: (a) the cost of abortion, (b) the cost of treating incomplete induced abortion, and (c) additional costs associated with unwanted pregnancies that are not associated with normal pregnancies. These latter costs are not well documented for industrial or developing countries.

There are enormous differences from country to country in laws covering abortion. Where it is legal, the method is relatively safe in the first trimester and the costs are mainly those associated with the abortion itself. Estimates from the UN indicate that about 40 percent of the women in developing countries have access to legal induced abortion. This ranges from 10 percent in Africa to 50 percent in Asia (40 percent in Latin America; United Nations 1988, table 38). The laws on abortion differ dramatically, however. In thirteen of ninety-six developing countries reviewed, it was illegal under all circumstances, and in only seven was it available on request. In the vast majority it is available for health reasons, but in most, only to save the life of the mother (forty-two of ninety-six). Thirty-five countries permit abortion for health reasons. Such laws permit wide latitude to doctors in preforming abortions and give access to safe abortion to most women who can pay doctors fees. The price of private legal abortion ranges from $16 in Bangladesh to $966 in Iraq. The normal range is between $100 and $200 in countries for which data are available (Ross and others 1988). Publicly provided abortions are free in a number of countries, but fees of under $100 are charged in several countries.

For women with no access to safe abortions, the cost of abortion complications must be added to the cost of the abortions themselves. It is impossible to get an estimate of the number of illegal abortions performed throughout the world or their cost. Evidence of abortion complications from hospital admissions is the best index. The "Population Reports" of July 1980 by Liskin compiled data on complications of abortions up to that time. It estimated that, depending on the country, between 4 and 70 percent of maternal deaths in developing country hospitals were the result of complications of illegal abortion. A recent study on illegal abortion by Figa-Talamanca and others, assessed the medical costs of illegally induced abortion in urban hospitals in four developing countries. For Malaysia, 52 percent of the abortion cases admitted were estimated to be induced, whereas only 12 percent of those in Nigeria were. In Turkey, 41 percent were estimated to be induced. There are no estimates immediately available of the economic costs of those abortions, but the induced abortion cases experienced high costs in hospital days, units of blood administered, and cost of medication (table 16-15). The cost in disability and ill health from these illegal abortions has not been estimated.

Priorities

Priorities for resource allocation depend on the level of demand for family planning and the level of mortality.

Priorities for Resource Allocation

A considerable amount of evidence has been compiled in various sources on the unmet demand for family planning to limit births and to a lesser degree to space births (see table 16-5 for data; Westoff and Moreno 1989 for a deeper analysis for five Latin American countries). As discussed above, we estimate that about a third of the births in the developing world

Table 16-15. Cost-Related Indices of Induced and Spontaneous Abortions in Four Participating Centers[a]

Parameters, by center	*Induced abortion*	*Spontaneous abortion*
Mean length of hospitalization (days)		
Malaysia	4.8	4.5
Nigeria	10.5	7.5
Turkey	1.7	1.0
Venezuela		
Caracas	4.2	2.4
Valencia	5.3	2.5
Mean units of blood administered		
Malaysia	0.2	0.1
Nigeria	0.6	0.2
Turkey	—	—
Venezuela		
Caracas	0.5	0.2
Valencia	1.0	0.5
Relative cost of medication[b]		
Malaysia	1.9	1.0
Nigeria	—	—
Turkey	1.5	1.0
Venezuela	8.8	1.0

— Data not available.
a. Data refer to cases classified as shown in Table 16-6.
b. Computed by considering the spontaneous abortion cost equal to unity.
Source: Figa-Talamanca and others 1986.

outside China are unwanted, and excess fertility would be even higher if births that come too soon were to be included. This implies substantial unmet need for family planning.

It is difficult to estimate what would be necessary to meet all the need for family planning as expressed by individuals. The analysis above indicates that in areas where mortality is low or demand to limit family size is 30 percent or more the savings from public health and education expenses alone are sufficient to justify public expenditure on family planning to avert a birth.[41] Where the demand to limit the number of births is lower, as in much of Sub-Saharan Africa, the cost of averting a birth is much higher. Because of this the economic justification for supporting family planning is less compelling, but given much higher maternal, infant, and child mortality in these areas the health justifications are more important (see table 16-9 for the cost of averting an infant or child death through family planning for spacing). In addition, reducing mortality is an important factor in stimulating more demand for family planning.[42] Even in areas of low demand, however, at rates of discount of 5 percent it is justifiable that the public fully support the prevention of all births that are unwanted by the family.

The level of expenditure needed to eliminate all fertility that is unwanted by the family is difficult to calculate. The estimate in table 16-6 that 11.6 million births were unwanted in the countries for which we have data is, of course, an underestimate because those countries included only 39 million of the approximately 113 million births that occurred in the developing world in the average year in the late 1980s. The estimates in table 16-14 show an average estimate of about $125 per birth averted in 1987 prices. Preventing the 11.6 million births would cost $1.5 billion. If one can generalize from the WFS data, 30 percent of all births in the developing world are unwanted and preventing them would cost $4.2 billion per year. The United States Agency for International Development (USAID) estimates that $1.5 billion was spent on family planning in 1980 and that $3 billion would be needed in 1990 (Gillespie and others 1988). The USAID estimates imply that if the WFS figures are representative of the world as a whole, substantial increases in funding will still not be sufficient to cover current users plus all those women who want no more children and are not using contraception. Our estimate is that this figure would be $4.6 billion in 1987 prices. This could not cover the unmet need for contraception for spacing. Regardless of exact current resource needs in 1990, by the year 2010 the number of currently married women of reproductive age will have doubled according to USAID estimates. Therefore the expenditure on family planning in the developing world is substantially below what is needed to eliminate unwanted fertility by the estimates of individuals, and those resource requirements are increasing rapidly. The geographic distribution of expenditure is more controversial because of the large difference in geographic distributions of excess fertility by societal and individual estimates of excess fertility. Therefore we know that a substantial increase in expenditure in family planning is needed. There is, however, a large number of factors that are not known.

Priorities for Research

Research in contraceptive technology is needed primarily in the following areas: (a) reversible sterilization, (b) male contraceptive methods, and (c) understanding of the interaction between various contraceptives and AIDS. Reversible sterilization has high priority, not only to expand the range of choice of individuals, but also to meet the requirements of Islamic teachings on what is acceptable.[43] Male contraceptives are needed for a number of reasons. Evidence is accumulating that in many parts of the world husbands do not want significantly more children than their wives, and in some cases they want fewer (Mason and Taj 1987). Therefore it is important to provide them with more methods from which to choose. The interaction of contraception and AIDS is, as explained earlier, an important question in gaining access to the effectiveness and safety in contraceptives.

Although the lack of a perfect contraceptive for all users restricts use to some degree, there are important research questions that still need to be addressed in service delivery, not to mention motivation. As indicated earlier, a large number of women in the developing world who are motivated to limit their fertility or space their births are not using contraception, and many of them say that they do not intend to do so in the future. One important area of research is the ambivalence toward family planning. There has not been a large compendium of information from surveys on why women say they are not using or do not intend to use contraceptives, particularly among the women who want no more children or want to postpone their next birth.[44] Data that have been compiled indicate that there are wide differences in reasons for nonuse of contraception among those who do not want another child. In Nepal and Mexico the main reason was lack of knowledge of a source.[45] Fear of side effects was a prime reason in Asia and Latin America. In three countries of Latin America in the late 1970s, the cost of contraception was also a significant deterrent. Lack of access is not mentioned frequently in African surveys, although it is probably important. In addition, few of the surveys find the opposition of husbands a great problem. In the recent Demographic and Health Surveys, lack of knowledge of contraception was the main reason given in Ghana, conflict with religion and custom was given as an important reason for nonuse of contraception in Senegal, and health concerns about contraceptives were most important in Nigeria. Clearly more research is needed on why people who want to limit fertility do not use contraception. This work should focus on trying to design strategies for family planning delivery which are specific to the concerns of the country. Increasing attention is being given to the quality of service as a dimension of access that affects not only use but efficency of use and continuation.

A final area that needs attention is the determinants of family size preferences themselves. As indicated earlier, particularly in Sub-Saharan Africa, there is a discrepancy between what individuals may consider excess fertility and what might be excessive from the point of view of economic growth and development. It may well be that one reason for the large family size preferences is the lack of access to reliable family

planning services. The effect of service access on family size preferences is not well studied in the literature. There is good theoretical reason to believe not only that the access to family planning affects the use of contraception among those who want to limit their fertility, but also that it directly affects whether they wish to limit it (Cochrane and Cochrane 1971 and 1974). The prior question of whether they perceive fertility as a choice is probably related to access as well, but this has not been well researched.

Finally, it is essential to gain a better understanding of contraception for spacing: its determinants and its demographic consequences. This knowledge is basic to the development of family planning services that are best suited to societies such as those in high-mortality countries of Africa, where there is low motivation to limit fertility but high motivation to space births. The role of breastfeeding in the fertility decisionmaking also needs to be more completely researched, especially with respect to spacing.

Appendix 16A. Tables

The tables in this appendix show the relationships between childbearing patterns and the survival of offspring, by country.

Table 16A-1. Total Fertility Rate, Crude Birth Rate, and Rate of Natural Increase, by Country

Country	1960–65			1970–75			1980–85			1985–90		
	TFR	CBR	RNI	TFR	CBR	RNI	TFR	CBR	RNI	TFR	CBR	RNI
Sub-Saharan Africa												
Benin	6.8	4.8	16	6.8	50	23	7.0	51	30	6.5[a]	49	33[a]
Cameroon	5.7	43	20	5.7	42	23	5.8	43	27	7.0[a]	48	35[a]
Côte d'Ivoire	6.6	43	18	6.7	45	24	6.7	46	30	7.0[a]	48	34[a]
Ghana	6.5	48	28	6.5	47	30	6.5	47	32	6.3[a]	45	32[a]
Kenya	8.1	57	35	8.2	57	3.9	8.1	55	41	7.7[a]	52	41[a]
Lesotho	5.8	43	20	5.7	43	33	5.8	42	25	5.8[a]	41	28[a]
Liberia	6.3	46	23	6.4	46	26	6.9	49	31	6.6[a]	46	33[a]
Mauritania	6.9	50	23	6.9	50	26	6.9	50	29	6.5[a]	48	30[a]
Nigeria	6.9	42	28	7.1	51	31	7.1	50	33	6.9[a]	50	34[a]
Senegal	6.7	47	21	6.7	47	25	6.5	46	37	6.5[a]	45	28[a]
Sudan	6.7	47	22	6.7	47	25	6.7	46	29	6.6[a]	45	29[a]
Latin America and the Caribbean												
Brazil	6.1	42	30	4.7	34	24	3.8	29	22	3.4	28	21[a]
Colombia	6.7	45	32	4.8	33	24	3.9	29	23	3.2	27	20
Costa Rica	6.9	45	36	4.3	31	26	3.5	31	24	3.3	28	24[a]
Dominican Republic	7.3	48	32	6.3	42	31	4.2	33	25	3.8	31	25[a]
Ecuador	6.9	46	31	6.0	41	30	5.0	35	31	4.3[a]	33	26[a]
Guyana	6.0	40	32	4.5	33	25	3.3	29	23	3.1	27	20
Haiti	6.1	44	23	6.1	43	23	5.7	41	27	4.7[a]	35	22[a]
Jamaica	5.5	40	31	5.4	33	25	3.4	28	23	2.9	26	20
Mexico	6.7	45	34	6.4	43	34	4.6	34	27	3.6	28	23[a]
Panama	5.9	41	31	4.9	36	28	3.5	28	23	3.1	26	21[a]
Paraguay	6.6	42	30	5.7	38	30	4.9	36	29	4.6[a]	35	29[a]
Peru	6.9	46	29	6.0	41	28	5.0	37	26	4.1[a]	32	23[a]
Trinidad and Tobago	5.0	38	31	3.5	27	20	2.9	25	18	2.8	26	19
Venezuela	6.5	44	35	5.0	36	29	4.1	33	27	3.8	31	26[a]
Asia												
Bangladesh	6.7	47	25	7.0	49	28	6.1	45	27	5.5[a]	40	25[a]
China	5.9	38	21	4.7	31	22	2.4	19	12	2.4	21	14
India	5.8	42	23	5.4	38	22	4.3	32	19	4.3[a]	22	20[a]
Indonesia	5.4	43	21	5.5	41	24	4.1	32	19	3.6	29	18
Malaysia	6.1	43	30	5.1	35	24	3.9	31	24	3.5	28	22[a]
Nepal	5.9	46	21	6.5	47	25	6.3	42	23	5.9[a]	41	24[a]
Philippines	6.6	44	31	5.3	37	26	4.4	33	25	3.9	30	23[a]
Korea, Republic of	5.4	40	27	4.1	29	20	2.6	23	17	2.1	20	14
Sri Lanka	5.1	35	26	4.0	29	21	3.4	28	21	2.8	24	18
Thailand	6.4	44	30	5.0	35	26	3.5	28	20	2.8	25	17
Middle East and North Africa												
Egypt	7.1	45	25	5.5	38	22	4.8	37	25	4.5[a]	34	24[a]
Jordan	7.2	48	29	7.4	47	35	7.4	45	37	5.8[a]	38	32[a]
Morocco	7.2	50	30	6.9	46	30	5.1	36	25	4.3[a]	32	23[a]
Pakistan	7.2	48	26	6.5	44	26	5.8	43	28	6.7[a]	47	33[a]
Syrian Arab Rep.	7.5	47	31	7.5	45	33	7.2	47	38	6.8[a]	45	38[a]
Tunisia	7.2	47	29	6.1	37	24	4.8	33	23	4.3[a]	31	23[a]
Turkey	6.0	41	26	5.5	37	25	4.0	30	21	3.7[a]	29	21[a]
Yemen, Republic of	7.0	49	21	7.0	49	23	7.0	49	30	6.8[a]	49	29[a]

Table 16A-2. Estimate for Main Effects Parameters in Model of Neonatal Mortality

Country	Base	Births in past 2 years: One alive	Births in past 2 years: One dead	Births in past 2 years: Two or more	Births in the past 2–4 years: One alive	Births in the past 2–4 years: One dead	Births in the past 2–4 years: Two or more	Mother's education: Medium	Mother's education: High	Birth order: Fourth to sixth	Birth order: Seventh or more	Birth order: First	Mother's age at birth: Less than 20	Mother's age at birth: 20–34	Mother's age at birth: 35 or more	Female child
Africa																
Senegal	–2.89	1.42	3.49	1.25	1.01	1.31	1.65	0.75	0.57	0.88	0.80	1.38	1.12	0.79	1.38	0.79
Benin	–2.89	1.02	2.72	2.34	0.79	1.55	1.07	0.81	0.42	1.21	1.75	1.07	1.23	1.13	0.76	0.81
Egypt	–3.71	2.46	4.10	4.22	1.21	1.86	1.88	0.74	0.53	1.28	1.28	3.06	1.19	1.30	1.57	0.75
Côte d'Ivoire	–2.90	1.07	2.36	1.39	1.06	2.01	1.60	0.69	0.29	0.91	1.07	2.27	1.26	1.06	1.20	0.69
Cameroon	–3.46	1.36	3.10	2.39	1.06	2.08	1.68	0.87	0.51	1.09	1.08	1.88	1.25	1.14	1.05	0.96
Mauritania	–3.60	1.75	3.67	5.75	1.03	2.53	1.62	1.63	1.14	0.79	1.21	2.05	1.06	0.77	1.21	0.61
Lesotho	–2.90	1.70	3.60	6.82	0.93	1.73	1.25	0.90	1.11	0.81	1.32	1.27	0.91	1.02	1.20	0.90
Kenya	–3.70	1.57	3.16	1.90	1.00	1.80	1.03	0.84	0.67	1.15	1.52	2.61	1.21	1.13	0.95	0.79
Morocco	–3.80	2.77	3.53	2.92	1.08	1.28	1.52	0.57	0.78	1.01	1.39	3.10	1.09	0.91	1.27	0.84
Sudan	–3.61	1.63	4.53	2.48	1.13	2.83	1.68	0.64	0.87	1.16	0.89	2.29	1.09	0.76	1.55	0.66
Ghana	–3.77	1.49	3.10	3.90	1.13	3.06	1.19	0.82	0.83	1.19	1.88	2.44	1.05	0.97	0.79	0.86
Tunisia	–5.50	2.03	8.08	11.36	1.65	3.97	3.46	0.96	0.01	0.64	1.07	2.25	1.65	0.97	1.26	1.06
Average	–3.56	1.69	3.79	3.89	1.09	2.17	1.63	0.85	0.64	1.01	1.27	2.14	1.18	1.00	1.18	0.81
Asia and the Pacific																
Yemen, Republic of	–3.22	1.25	2.72	2.77	0.91	1.02	0.96	0.63	0.83	1.02	1.62	1.49	1.73	1.39	0.61	0.72
Nepal	–2.88	1.58	2.32	1.42	1.02	2.10	1.67	0.80	0.63	0.95	1.15	1.60	1.49	1.17	1.02	0.91
Bangladesh	–3.01	1.99	3.94	3.71	1.14	1.54	1.65	0.89	0.76	0.71	0.90	2.59	1.09	0.85	0.57	0.94
Pakistan	–2.87	1.32	3.06	2.46	1.02	1.62	1.51	0.80	0.66	0.93	0.93	1.84	1.42	1.07	0.97	0.76
Indonesia	–3.50	1.99	2.36	3.19	1.13	1.90	1.77	0.76	0.73	1.05	1.22	1.49	1.72	1.17	1.02	0.82
Thailand	–3.92	2.20	3.97	5.87	1.48	2.61	2.59	0.88	0.39	0.98	1.03	2.80	1.43	1.25	1.22	0.87
Philippines	–3.91	1.62	2.32	2.53	0.68	1.88	1.07	0.90	0.68	1.57	1.65	1.54	1.25	1.05	1.25	0.72
Syrian Arab Republic	–4.81	2.48	7.77	9.39	0.90	2.29	1.08	0.86	0.64	0.90	0.79	3.63	0.89	0.79	1.08	0.84
Jordan	–3.76	1.92	4.26	4.95	0.87	2.05	1.35	0.89	0.73	0.70	0.88	1.90	1.06	0.72	1.00	0.99
Sri Lanka	–3.21	1.36	3.67	3.32	0.95	2.83	1.51	0.77	0.54	0.76	0.61	1.79	1.11	0.85	1.77	0.71
Korea, Republic of	–5.05	2.16	2.80	0.04	1.12	3.56	1.42	0.84	0.40	0.53	0.49	1.65	1.88	1.45	1.05	0.84
Malaysia	–4.49	1.92	3.94	3.78	1.13	3.56	2.48	0.78	0.34	0.47	0.76	1.46	1.38	1.00	0.79	0.73
Average	–3.72	1.82	3.59	3.62	1.03	2.25	1.59	0.82	0.61	0.88	1.00	1.98	1.37	1.06	1.03	0.82
Latin America and the Caribbean																
Haiti	–3.00	1.43	3.74	1.03	1.02	1.67	1.21	0.90	0.41	1.58	1.12	1.40	1.43	1.17	0.87	0.90
Peru	–3.46	1.97	3.29	2.83	1.19	1.88	1.67	0.55	0.42	1.13	1.05	1.67	1.36	0.84	1.06	0.70
Ecuador	–3.49	1.68	2.86	2.61	0.87	1.67	1.25	0.73	0.64	1.19	1.16	1.43	1.38	1.00	1.46	0.79
Colombia	–3.30	1.34	4.01	3.42	0.98	2.41	1.26	0.81	0.47	0.67	0.83	1.16	0.97	0.70	0.84	0.82
Mexico	–3.56	1.31	3.13	3.10	0.88	1.84	1.08	0.73	0.62	1.35	1.82	1.42	1.70	1.27	1.07	0.76
Costa Rica	–3.70	1.54	3.86	5.53	0.88	1.86	1.21	0.78	0.63	0.87	1.02	1.08	1.35	1.17	1.49	0.78
Guyana	–3.36	1.43	6.69	5.47	0.79	1.77	1.22	1.19	0.81	0.74	0.99	1.49	0.87	1.54	2.08	0.61
Panama	–3.60	1.72	5.75	3.56	0.81	1.42	0.54	0.49	0.55	1.49	1.01	1.80	1.11	0.95	2.53	0.79
Jamaica	–3.27	1.54	1.92	0.01	0.89	2.53	0.82	1.02	0.68	0.69	0.81	1.36	0.54	0.40	0.54	1.12
Trinidad and Tobago	–4.56	1.32	6.69	3.35	0.78	1.03	0.97	0.82	0.78	1.75	4.62	1.13	2.97	2.16	1.27	1.05
Average	–3.53	1.53	4.19	3.09	0.91	1.81	1.12	0.80	0.60	1.15	1.44	1.40	1.37	1.12	1.27	0.83
Europe																
Portugal	–4.30	1.21	9.49	5.58	0.75	2.51	2.23	0.86	0.84	1.30	0.72	2.59	1.12	0.94	1.67	0.61

Source: Hobcraft, McDonald, and Rutstein 1985.

Table 16A-3. Estimates for Main Effects Parameters in Model of Postneonatal Mortality

Country	Base	Births in past 2 years: One alive	Births in past 2 years: One dead	Births in past 2 years: Two or more	Births in the past 2–4 years: One alive	Births in the past 2–4 years: One dead	Births in the past 2–4 years: Two or more	Mother's education: Medium	Mother's education: High	Birth order: Fourth to sixth	Birth order: Seventh or more	Birth order: First	Mother's age at birth: Less than 20	Mother's age at birth: 20–34	Mother's age at birth: 35 or more	Female child
Africa																
Senegal	–2.90	0.65	2.34	3.46	1.21	1.36	1.35	0.80	0.54	1.21	1.09	0.99	1.36	1.39	1.03	0.97
Benin	–3.05	0.91	3.03	2.14	1.40	2.05	1.36	0.66	0.99	1.20	1.30	1.40	1.36	0.97	1.07	0.92
Egypt	–3.26	2.08	2.83	3.16	1.17	1.67	1.84	0.99	0.70	0.96	0.93	1.75	1.36	1.06	1.14	1.17
Côte d'Ivoire	–2.88	1.21	2.16	1.46	1.04	1.63	1.70	0.86	0.67	1.17	1.13	1.45	1.32	1.09	0.84	0.89
Cameroon	–3.12	1.84	2.80	3.42	0.92	1.51	1.46	0.59	0.46	0.99	1.12	1.65	1.17	1.12	1.22	1.13
Mauritania	–3.47	0.90	2.92	2.10	0.66	1.40	0.81	1.04	1.52	0.88	1.86	1.00	1.20	0.94	1.04	1.17
Lesotho	–3.50	1.73	2.18	2.80	1.32	2.20	1.93	1.02	0.76	1.77	1.68	1.26	1.93	1.27	0.79	1.03
Kenya	–3.29	1.75	3.86	3.42	1.02	2.12	1.79	0.77	0.45	0.89	0.96	1.65	1.38	0.90	0.95	0.95
Morocco	–3.79	1.82	3.06	2.94	0.97	1.43	1.46	1.13	0.87	1.16	1.73	1.68	1.46	1.23	0.92	0.96
Sudan	–4.02	2.03	5.42	5.16	1.28	3.49	2.83	0.66	1.21	0.48	0.74	2.53	1.12	1.16	1.04	0.86
Ghana	–3.60	2.39	4.01	3.86	1.02	3.32	1.72	0.58	0.68	0.88	0.84	1.14	1.28	1.22	1.17	0.78
Tunisia	–4.91	2.51	8.67	6.05	0.80	1.58	1.58	0.81	0.01	1.23	1.88	1.42	1.57	1.42	0.73	1.01
Average	–3.48	1.65	3.61	3.33	1.07	1.98	1.65	0.83	0.74	1.07	1.27	1.49	1.38	1.15	1.00	0.99
Asia and the Pacific																
Yemen, Republic of	–3.07	2.44	4.22	4.01	1.12	1.49	1.36	0.79	0.39	0.94	1.19	2.14	1.51	1.09	1.20	0.90
Nepal	–2.88	1.27	1.97	3.82	1.19	1.84	1.67	0.88	0.76	1.07	1.23	1.39	1.54	1.30	0.84	0.99
Bangladesh	–3.03	1.79	2.12	2.03	0.99	1.75	1.23	1.08	0.99	0.73	0.97	1.65	1.14	1.05	0.94	0.78
Pakistan	–3.33	1.62	2.44	2.75	1.16	1.65	1.51	0.88	0.84	1.07	1.01	2.01	1.08	0.96	1.00	1.15
Indonesia	–3.00	2.01	2.44	1.77	0.98	1.92	1.51	0.57	0.28	0.93	0.79	1.54	1.11	0.90	1.13	0.82
Thailand	–3.70	1.95	3.39	2.64	1.11	2.12	1.99	0.82	0.33	0.82	1.19	1.62	1.04	0.89	0.76	1.06
Philippines	–3.39	2.01	2.39	5.05	1.11	1.39	1.35	0.74	0.42	0.84	0.99	0.86	1.07	1.01	1.21	0.75
Syrian Arab Republic	–3.87	2.53	4.39	4.57	1.16	1.97	1.54	0.73	0.37	0.97	1.21	2.59	1.36	1.27	1.16	1.04
Jordan	–4.29	3.94	3.97	8.17	0.99	1.26	1.84	0.65	0.73	0.93	1.05	2.48	1.34	0.92	0.59	1.16
Sri Lanka	–4.28	1.46	1.52	2.69	0.98	1.86	1.63	0.91	0.80	1.45	1.95	1.06	1.30	1.17	0.66	0.92
Korea, Republic of	–4.47	2.12	6.49	6.42	1.31	2.48	2.20	0.61	0.70	1.27	1.45	2.14	1.42	0.93	1.17	1.00
Malaysia	–3.42	0.90	2.46	2.20	0.80	1.80	0.79	0.85	0.39	1.21	2.64	0.89	1.92	1.27	0.96	0.64
Average	–3.56	2.00	3.15	3.84	1.07	1.79	1.55	0.79	0.58	1.02	1.31	1.70	1.32	1.06	0.97	0.94
Latin America and the Caribbean																
Haiti	–2.97	1.80	2.80	2.80	1.20	1.73	1.99	1.92	0.87	0.84	0.86	1.46	0.95	1.06	1.09	0.84
Peru	–3.21	2.14	3.03	3.03	1.08	1.82	1.72	0.58	0.32	1.03	1.07	1.49	1.46	1.12	0.98	0.90
Ecuador	–3.52	1.68	3.22	3.13	0.93	1.67	1.60	0.95	0.39	1.20	1.52	1.68	1.35	1.04	0.83	0.82
Colombia	–3.79	2.72	3.49	4.66	0.97	1.92	1.75	0.43	0.58	0.83	0.83	1.62	1.30	0.95	1.14	0.90
Mexico	–3.66	1.84	2.05	2.64	0.81	1.63	1.65	0.87	0.27	0.97	0.95	1.20	1.34	1.12	1.03	0.84
Costa Rica	–4.06	1.97	2.89	5.00	2.05	3.29	3.39	0.92	0.56	0.78	0.97	1.88	2.05	0.92	1.52	0.62
Guyana	–4.26	1.70	4.06	3.39	1.73	2.94	1.60	1.03	0.88	0.70	0.76	1.42	0.95	0.89	0.82	0.94
Panama	–4.88	1.16	0.77	0.73	1.21	2.27	0.68	0.74	0.39	1.23	2.80	1.13	2.61	2.86	1.23	1.13
Jamaica	–5.34	2.64	9.21	1.63	1.70	2.29	1.23	1.07	0.90	1.01	1.65	1.43	3.22	1.27	1.40	0.91
Trinidad and Tobago	–5.54	2.23	4.10	3.25	1.28	5.31	0.90	1.17	0.80	1.67	2.86	2.86	1.27	1.46	0.69	0.77
Average	–4.12	1.99	3.56	3.03	1.30	2.49	1.65	0.97	0.60	1.03	1.43	1.62	1.65	1.27	1.07	0.87
Europe																
Portugal	–3.85	2.01	0.42	4.35	1.06	0.99	2.05	0.59	0.30	0.85	0.87	0.70	2.48	1.72	1.38	0.90

Source: Hobcraft, McDonald, and Rutstein 1985.

Table 16A-4. Estimates for Main Effects Parameters in Model of Toddler Mortality

Country	Base	Births in past 2 years: One alive	Births in past 2 years: One dead	Births in past 2 years: Two or more	Births up to one year later: Births	Births up to one year later: Pregnant	Mother's education: Medium	Mother's education: High	Birth order: Fourth to sixth	Birth order: Seventh or more	Birth order: First	Mother's age at birth: Less than 20	Mother's age at birth: 20–34	Mother's age at birth: 35 or more	Female child
Africa															
Senegal	–2.44	0.54	1.11	0.75	0.01	0.95	0.75	0.44	1.21	1.36	1.05	1.28	1.00	0.87	1.02
Benin	–3.45	0.79	1.45	0.40	2.18	2.12	0.61	1.00	1.73	1.16	0.75	2.18	1.25	0.97	0.91
Egypt	–3.49	1.62	2.61	2.18	2.46	1.95	0.89	0.61	1.17	1.15	1.17	1.22	1.05	0.99	1.30
Côte d'Ivoire	–3.12	1.00	0.91	3.42	1.92	2.05	0.75	0.67	1.00	0.87	1.16	1.22	1.01	0.86	0.83
Cameroon	–3.30	1.46	2.39	0.61	3.35	1.42	0.77	0.59	0.90	0.78	1.11	1.42	0.97	0.73	0.90
Mauritania	–3.66	0.79	1.80	1.73	1.86	2.36	0.89	0.76	1.36	1.15	0.84	1.15	1.20	1.23	1.14
Lesotho	–3.23	1.04	1.58	2.48	3.39	2.86	0.87	0.56	0.78	0.83	0.61	1.36	1.51	0.87	0.62
Kenya	–3.36	1.43	1.86	1.60	2.01	1.36	0.52	0.53	0.96	0.97	1.12	1.23	0.88	0.92	0.82
Morocco	–3.95	1.82	2.77	1.60	2.01	1.48	0.38	0.00	1.19	1.26	1.09	1.49	1.45	0.98	1.04
Sudan	–3.73	1.04	3.06	1.12	1.92	1.84	0.90	1.42	0.90	0.94	0.84	1.35	0.89	1.46	0.70
Ghana	–3.67	1.26	1.65	0.00	4.95	1.79	0.73	0.55	1.22	1.28	0.87	1.43	1.04	0.84	0.82
Tunisia	–6.62	1.46	2.48	3.56	3.94	4.31	1.57	0.03	1.65	1.97	1.21	1.75	1.58	0.78	0.93
Average	–3.67	1.19	1.97	1.62	2.50	2.04	0.80	0.60	1.17	1.14	0.99	1.43	1.15	0.96	0.92
Asia and the Pacific															
Yemen, Republic of	–3.62	2.80	5.42	2.14	2.12	1.99	0.55	0.75	0.94	0.64	1.84	0.62	0.77	1.02	1.22
Nepal	–2.87	1.46	2.08	1.21	2.10	1.60	0.66	0.29	1.03	0.91	1.01	1.05	0.82	0.73	1.06
Bangladesh	–4.60	1.79	1.45	2.92	2.69	2.69	0.86	0.76	1.40	1.38	1.28	1.77	1.46	1.03	1.31
Pakistan	–3.91	1.48	1.73	0.99	2.14	1.86	0.79	0.21	1.32	1.40	0.83	1.60	1.31	0.89	1.40
Indonesia	–3.73	1.70	2.41	1.90	3.13	2.75	0.83	0.26	1.27	1.45	0.96	1.46	1.12	0.48	0.88
Thailand	–4.79	1.88	3.82	0.00	4.06	3.86	0.76	0.00	0.94	1.63	0.37	1.07	0.98	0.90	0.69
Philippines	–4.06	1.27	2.20	1.32	1.58	1.63	0.68	0.36	1.20	1.46	0.56	1.55	1.04	0.73	0.98
Syrian Arab Republic	–4.75	1.68	2.14	2.27	1.43	1.55	0.66	0.73	1.19	1.39	0.80	1.60	0.90	1.15	0.89
Jordan	–4.18	2.01	3.13	5.26	1.48	1.55	0.65	0.30	0.76	0.68	1.04	0.99	0.88	0.44	1.08
Sri Lanka	–5.67	1.52	1.34	2.34	4.14	0.78	1.06	0.68	2.61	2.61	1.57	2.66	1.77	0.81	1.13
Korea, Republic of	–6.49	2.97	2.56	0.07	4.66	5.47	0.71	0.23	1.58	1.16	2.32	1.88	0.70	1.86	2.72
Fiji	–5.13	2.18	0.01	3.10	1.17	0.33	1.79	1.49	0.86	0.43	0.82	0.97	0.12	0.33	0.66
Malaysia	–5.35	0.98	3.53	0.01	1.62	1.38	1.17	0.00	1.17	1.90	0.30	1.43	0.99	1.77	0.53
Average	–4.55	1.83	2.45	1.81	2.49	2.11	0.86	0.47	1.25	1.31	1.05	1.44	0.99	0.93	1.12
Latin America and the Caribbean															
Haiti	–3.34	1.06	2.20	6.17	1.02	1.22	0.00	0.89	1.13	0.63	1.13	1.03	0.84	1.09	0.76
Peru	–3.49	1.95	2.32	1.77	2.10	1.90	0.27	0.14	0.94	0.96	1.35	0.91	0.89	0.89	1.12
Dominican Republic	–3.78	1.45	1.34	3.29	3.42	1.39	0.58	0.23	1.14	0.87	0.43	1.52	1.22	1.09	1.27
Ecuador	–3.86	1.45	1.90	1.03	2.08	1.62	0.58	0.34	1.13	1.16	0.63	2.46	1.92	1.32	0.91
Colombia	–4.46	1.62	2.23	3.00	1.67	1.08	0.76	0.22	0.84	0.61	0.61	1.54	1.51	1.40	1.60
Mexico	–4.56	1.35	2.75	2.41	3.16	1.62	0.53	0.33	1.77	1.51	0.70	2.32	1.38	1.03	0.85
Paraguay	–4.54	1.19	0.57	0.01	1.72	1.75	0.76	0.54	1.07	1.28	0.55	1.17	1.77	1.08	0.69
Costa Rica	–4.76	0.96	2.12	2.92	2.34	1.17	0.44	0.28	1.30	2.14	0.85	2.61	1.62	0.92	0.98
Guyana	–6.36	1.19	2.16	2.48	1.67	2.29	1.60	1.38	2.48	3.32	0.78	4.66	1.22	2.03	0.76
Venezuela	–4.62	1.05	1.21	1.54	0.92	1.13	0.62	0.00	0.97	1.43	0.95	1.03	1.72	0.76	0.79
Panama	–4.39	1.15	1.27	1.28	2.23	0.80	0.57	0.30	1.21	1.48	0.83	1.34	1.14	1.06	0.98
Jamaica	–4.22	1.21	0.98	0.01	1.80	0.48	0.68	0.45	1.28	1.62	1.20	2.94	1.11	0.87	0.66
Trinidad and Tobago	–6.55	0.95	0.01	0.01	2.64	1.79	1.43	0.91	0.78	1.90	0.66	2.20	2.61	0.90	2.44
Average	–4.53	1.27	1.62	1.99	2.06	1.40	0.68	0.46	1.23	1.45	0.82	1.98	1.46	1.11	1.06
Europe															
Portugal	–6.50	4.10	6.82	0.01	5.64	1.21	0.35	0.32	1.75	1.08	0.98	5.64	1.54	2.08	1.09

Source: Hobcraft, McDonald, and Rutstein 1985.

Table 16A-5. Estimates for Main Effects Parameters in Model of Child Mortality

Country	Base	Births in past 2 years: One alive	Births in past 2 years: One dead	Births in past 2 years: Two or more	Births up to 1 year later: One or more alive	Births up to 1 year later: None alive	Births up to 1 year later: Pregnant	Mother's education: Medium	Mother's education: High	Birth order: Fourth to sixth	Birth order: Seventh or more	Birth order: First	Mother's age at birth: Less than 20	Mother's age at birth: 20–34	Mother's age at birth: 35 or more	Female child
Africa																
Senegal	–2.34	0.70	0.83	0.00	0.89	0.67	0.00	0.73	0.22	0.83	1.17	0.91	1.12	1.15	0.72	1.05
Benin	–2.37	0.76	1.35	0.76	0.95	1.09	2.80	0.50	0.43	0.87	0.88	0.84	1.11	1.03	1.06	0.95
Egypt	–3.54	1.73	1.60	1.99	1.40	1.54	2.39	0.82	0.57	1.43	1.30	0.64	1.22	0.94	0.83	1.15
Côte d'Ivoire	–3.04	1.27	1.16	0.00	1.20	1.31	0.00	0.90	0.43	1.13	0.84	0.76	1.62	1.14	1.11	0.88
Cameroon	–2.90	1.28	1.86	1.16	0.95	1.58	1.57	0.63	1.97	1.27	1.46	1.51	0.79	0.87	0.95	1.03
Mauritania	–2.74	0.98	0.90	1.95	0.96	1.54	1.93	1.17	0.52	1.16	1.26	0.66	1.34	0.96	1.17	1.06
Lesotho	–3.47	2.97	0.75	0.01	0.92	0.64	0.01	0.63	0.49	1.43	0.45	1.12	1.73	1.68	1.14	0.68
Kenya	–3.57	1.21	1.70	1.75	0.99	1.09	0.83	0.59	0.74	1.05	1.49	0.78	1.40	0.96	1.16	0.95
Morocco	–4.06	1.84	1.63	2.69	1.01	1.79	2.69	0.27	0.00	1.39	1.55	1.17	1.52	1.07	1.11	0.84
Sudan	–3.68	1.19	1.36	1.73	1.19	3.03	1.93	0.52	2.29	1.21	1.23	0.71	1.26	0.86	1.54	1.27
Ghana	–3.61	1.54	1.15	0.00	1.35	2.97	1.09	0.30	0.38	1.03	0.85	0.99	2.10	1.27	1.55	0.96
Tunisia	–5.11	2.25	5.75	4.44	2.16	2.34	3.03	0.51	0.01	1.30	1.62	1.31	1.00	1.27	1.14	1.42
Average	–3.37	1.48	1.67	1.38	1.16	1.63	1.52	0.63	0.67	1.18	1.18	0.95	1.35	1.10	1.12	1.02
Asia and the Pacific																
Yemen, Republic of	–3.27	3.25	1.95	4.44	0.85	1.09	1.58	0.58	0.60	0.81	0.68	1.55	1.16	0.87	0.87	1.23
Nepal	–3.36	1.31	1.08	1.90	1.31	2.14	3.13	0.65	0.24	1.52	1.58	0.78	1.67	1.21	0.59	1.07
Bangladesh	–3.14	1.63	1.23	2.53	1.73	1.28	1.63	0.73	0.39	1.09	0.98	0.96	1.00	0.88	0.97	1.13
Pakistan	–3.42	1.52	1.28	1.46	1.05	1.49	1.08	0.68	2.61	1.11	0.97	0.76	1.43	1.17	1.20	1.31
Indonesia	–3.26	1.25	1.48	2.72	2.18	1.42	3.35	0.64	0.19	1.00	1.15	0.80	1.52	1.03	0.90	0.77
Thailand	–4.34	1.55	0.85	3.10	1.65	2.27	3.16	0.73	0.19	1.58	1.60	0.64	1.14	1.17	0.56	1.57
Philippines	–4.64	1.63	2.77	1.77	1.31	1.25	2.16	0.83	0.25	1.51	1.79	1.02	1.48	1.00	0.59	0.89
Syrian Arab Republic	–4.91	1.23	2.75	1.16	1.17	1.32	1.67	0.31	0.16	1.62	1.35	0.84	0.91	1.09	0.41	1.32
Jordan	–4.94	1.93	1.90	3.46	1.11	1.51	0.84	0.12	0.22	1.14	0.64	0.73	1.65	1.07	0.53	0.79
Sri Lanka	–4.10	1.08	0.79	0.50	1.72	2.32	0.46	0.68	0.35	1.21	1.73	0.56	1.14	0.85	0.55	0.96
Korea, Republic of	–6.08	0.59	3.35	0.03	1.70	0.02	0.03	0.61	0.44	0.76	0.21	2.05	1.51	2.97	4.95	0.88
Fiji	–5.38	0.67	1.04	301.87	0.81	0.00	0.00	1.12	1.73	1.14	0.77	0.28	0.54	0.97	1.04	1.05
Malaysia	–5.80	0.77	1.19	6.89	1.58	0.01	0.02	0.58	0.38	2.25	1.79	0.47	4.57	0.77	2.69	0.90
Average	–4.36	1.42	1.67	22.24	1.40	1.24	1.47	0.64	0.60	1.29	1.17	0.88	1.52	1.16	1.22	1.07
Americas and the Caribbean																
Haiti	–2.80	1.40	1.03	0.00	1.06	1.02	3.13	1.27	0.52	0.73	0.37	0.76	1.55	0.94	1.39	1.06
Peru	–3.93	1.35	1.21	1.48	0.98	1.42	4.35	0.30	0.15	1.46	1.65	0.73	2.27	1.39	0.95	1.20
Dominican Republic	–3.76	1.43	0.75	1.26	1.26	1.48	0.52	0.55	0.16	0.39	1.02	0.71	1.58	1.30	0.41	1.05
Ecuador	–4.01	1.07	1.54	1.90	1.55	2.77	2.41	0.54	0.34	0.98	1.12	0.68	0.89	1.31	0.84	1.09
Colombia	–3.90	1.31	1.52	0.85	1.28	1.93	4.62	0.62	0.18	1.08	0.88	0.92	1.04	0.83	1.55	1.02
Mexico	–3.98	0.88	0.91	0.74	1.05	0.78	4.22	0.32	0.05	1.27	1.03	0.80	1.46	0.64	1.05	1.19
Paraguay	–4.19	1.15	0.58	1.51	1.16	1.25	0.02	0.38	0.15	0.95	1.86	0.89	1.30	1.55	0.85	0.36
Costa Rica	–5.32	1.17	0.57	2.46	1.30	2.59	4.35	0.63	0.00	1.79	1.21	0.80	0.76	0.68	1.42	1.49
Guyana	–4.63	1.27	0.80	0.00	1.04	0.00	0.01	1.07	0.47	1.20	0.85	1.49	0.00	0.42	1.04	0.91
Venezuala	–5.56	2.14	0.01	5.75	1.09	3.25	4.85	0.38	0.12	1.88	1.36	2.41	1.30	1.63	0.01	1.23
Panama	–5.20	0.85	0.78	0.01	1.86	0.01	3.39	0.35	0.32	1.58	2.03	1.45	2.16	1.34	0.53	1.31
Jamaica	–7.51	6.11	8.76	0.04	2.59	0.01	0.01	0.19	0.21	3.74	2.61	24.53	0.78	0.56	1.04	1.51
Trinidad and Tobago	–7.81	0.48	0.70	0.02	2.86	20.49	31.19	0.00	1.55	0.49	2.46	1.19	1.14	0.79	0.00	2.66
Average	–4.82	1.59	1.47	1.23	1.54	2.85	4.85	0.51	0.33	1.35	1.42	1.00	1.25	1.03	0.85	1.24
Europe																
Portugal	–9.86	4.57	0.00	0.00	2.18	0.00	0.00	3.00	6.75	6.36	15.64	1.14	16.12	6.17	1.25	0.80

Source: Hobcraft, McDonald, and Rutstein 1985.

Notes

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1. The countries selected were, for the most part, countries in which survey data allow us to compare these aggregate measures of fertility and excess fertility with individual reports of excess fertility or the desire to cease childbearing. Unfortunately, China, India, and Brazil have no World Fertility Survey data sponsored by USAID and UNFPA available to draw on for comparisons, but Brazil has participated in the more recent Demographic and Health Survey, sponsored by USAID.

2. The dramatic nature of these declines in fertility can be observed by a decline by half in the TFR between the early 1960s and the late 1980s in Colombia, Costa Rica, and the Dominican Republic and by 40 percent or more in Brazil, Ecuador, Mexico, and Venezuela.

3. Half or more of the developing countries of all regions except central west Asia perceived their population growth as being excessive. None of the countries in the Economic and Social Commission for Africa (ESCWA) had that perception (United Nations 1989, p. 14).

4. Governments of 68 of 131 developing countries have reported to the United Nations that fertility is too high in their country (United Nations 1989, p. 14).

5. See the National Research Council's review for detailed discussion of the health consequences for women and children in developing countries of contraception and reproduction (NRC 1989).

6. This summation represents a simplification. In a period of transition, such as the baby boom in the United States after World War II, the TFR can be much higher than the average parity. Such a situation occurs if women have been postponing their first and second births and all women of different ages are having low-parity births at the same time.

7. It should be noted that in these microeconomic studies, the percentage at risk because of high parity is much larger than the percentage by which the TFR exceeds four. The reader should bear this in mind when interpreting the figures in table 16-3.

8. See footnotes to table 16-3 for descriptions of how the number of women in various categories are assigned to categories of excess births.

9. Asia's pattern is distorted by the very low fertility in China.

10. More recent data from Kenya would give lower excess fertility, 43 and 83 percent, respectively, by these measures but higher excess fertility by preference measures.

11. Although most surveys report data only for women, a number of surveys report men's family size preferences. Contrary to what is generally believed, men do not systematically report higher fertility preferences than women (Mason and Taj 1987). Perhaps the men do bear some costs of higher fertility by having to work harder to support larger families in those environments where marriages are stable.

12. Time constraints have not allowed the recalculation of these artificial TFRs for more recent years.

13. Bongaarts, Mauldin, and Phillips (1990) estimate unwanted fertility preferences for the developing world, including China, at 21 percent. In China and a number of countries in Africa, there is deficit fertility which has not been netted out of these estimates.

14. In every country the youngest women report lower fertility preferences than the oldest women. Part of this may result from reporting bias mentioned above and part from genuine declining preferences.

15. A birth postponed will reduce the rate of growth in the short term. In addition, many births that are postponed never take place.

16. More recent Demographic and Health Surveys show that more than 20 percent of the women wish to cease childbearing in Burundi, Ghana, and Ondo State in Nigeria.

17. The proportions of women who wish to limit their fertility in the three countries are 30 percent, 23 percent, and 64 percent, respectively. The proportions currently using contraceptives are 25 percent, 12 percent, and 53 percent, respectively.

18. Because many of those who wish to space a child will go on to have further births, there is no correct assumption that would allow the conversion of spacing into excess births. Therefore, one-half was chosen as an arbitrary figure. It is clearly incorrect to assume that all those who wish to space should be counted. Likewise it is incorrect to assume that the spacers account for no excess fertility. In these models, 26 percent, 38 percent, and 14 percent of the women wish to space their next birth.

19. The three main arguments why increased contraception will not improve survival rates are (a) that reducing high parity births will result in a larger proportion of births being first births and these births have even higher mortality than high-parity births; (b) that these correlations are not causative but are associated with other characteristics of the mother or family, such as low education and economic status; and (c) that changes in contraceptive use may be associated with other changes in behavior, such as the reduction of breastfeeding, which will cause increased health risks.

20. The biological mechanisms to explain these relationships have not been identified (Haaga 1989).

21. This is an underestimate to the extent that it ignores the intervals in which a child was born in the preceding twelve months and then died. In those cases, the causal issues are more complex. It also ignores the effect of the postponed birth on the mortality risk of previous children.

22. Here and throughout, 1987 U.S. dollars are used.

23. This estimate is based on the cost of Community-based distribution (CBD) programs as estimated from a number of countries by Cochrane, Hammer, Janowitz, and Kenney (1990).

24. This corresponds to a mid-range of costs for a couple-year of protection for clinic-based distribution of oral contraceptives and intrauterine contraceptive devices (Cochrane and others 1990).

25. The health costs of high fertility and close spacing of children are discussed in chapter 17, this collection. Family planning can reduce maternal mortality in two ways: (a) the fewer the births a woman has, the fewer her exposures to the risk of maternal mortality, and (b) by confining births to the healthiest age groups and spacing births to the best intervals, the risk of death associated with every birth that does take place is reduced. There exist various estimates of the effect of family planning on mortality. It has been estimated that 24 percent of maternal deaths could be averted by contraceptive use by fecund women not currently using contraception but desiring no more births (Sai and Nassim 1987).

There has been somewhat of a revision of position in the development community in the United States and the development agencies away from the dire predictions of the negative consequences of rapid population growth (NRC 1986) just at the time that some Latin American and French scholars and African politicians are becoming more concerned (Blanchet 1988; Paiva 1988).

26. See Birdsall, Cochrane, and Van der Gaag (1987) for a review of the methodological issues and estimates of child costs in industrial countries. See Lindert (1980) for a review of the estimates available for developing countries. In addition Deaton and Muelbauer (1986) have recently estimated the costs of a child in Sri Lanka and Indonesia.

27. One reason it is so hard to determine the consequences of high fertility is that the causation goes in two directions and income can affect fertility as well as the converse.

28. Neither is there a well-defined range of the cost of a child, since the effect of a child on his or her parents and other siblings varies substantially from one environment to another. Deaton and Muellbauer (1986) estimate that parents spend about 30 to 40 percent of what they spend on themselves on a child in Sri Lanka and Indonesia. Because they do not include the time or opportunity costs that the child imposes on others in the family, these expenditures are only part of the costs to a family of an additional child.

29. See King 1970 for an example for Jamaica.

30. The exchange rate between the peso and the U.S. dollar was 120 in 1983.

31. These estimates are too large to the extent that there are economies of scale, and thus marginal costs of a child are below average costs. The estimates are made assuming a government commitment to universal primary education

and a progression rate from primary to secondary education similar to current patterns in the country. Costs are obtained from two World Bank internal documents: "Comparative Education Indicators" for recurrent costs and "Unit Cost Estimates" for the capital costs. These costs have been inflated to 1987 as a base. Because no unit recurrent costs are available for secondary school we have assumed that the ratio of recurrent secondary recurrent costs to primary recurrent costs reflects the ratio of their respective capital costs per school place. There is no comparable measure of the health costs to be saved by a birth averted. *Financing Health Services in Developing Countries: An Agenda for Reform* (World Bank 1987) provided the per capita health expenditure for a range of countries that can be used as a first approximation. For the two poor, high-mortality countries the annual per capita public expenditure on health of Sri Lanka and China have been used, $6. For the low-mortality country an average of seven countries has been used, yielding $28 per capita. The education costs have not been adjusted to reflect the age structure of mortality. The education figures would be at least 17 percent lower if the probability of survival to age five were used to adjust the figures. The health expenditure for each country does reflect mortality to the extent that the number of years included depends on the life expectancy in the model country. A more sophisticated method would weigh health cost in each year by the survival cohort for that age. This would require information on expenditure by age, which is not available. The authors of chapter 17 in this collection are preparing estimates of costs that could be used in the calculations here as well if an age profile of expenditure were to be used.

32. In Northern Nigeria in 1981 the median age of first marriage was fifteen, which means that half the women are married by that age or earlier (*Nigeria Fertility Survey 1981/1982*, published in 1984 by the National Population Bureau).

33. The health benefits of breastfeeding are substantial but must be balanced against the time and nutritional costs to the mother. This is a topic that has been extensively discussed in the literature.

34. A more comprehensive list of failure rates by method and study is available in Trussell and Krost (1987). Their estimates include an estimate of failure rates for Norplant (a contraceptive implant) of 0.2 compared with 2 to 2.5 for oral contraceptives.

35. These estimates are taken from general data sets. For actual policy analysis in a country, detailed analysis of the family planning delivery system would be necessary.

36. There is some evidence that real costs per user have dropped since 1980 in Indonesia even when costs of the health delivery of the family planning program are included (World Bank 1990).

37. There are two main reasons why costs would drop the more women are motivated to cease childbearing. First, the more motivated the women, the more likely they are to be using contraception. If there are economies of scale, then costs would fall. Second, the more motivated women are, the less money needs to be spent on motivation and the less extensive the delivery system needs to be, because presumably the more motivated women will travel further to get services.

38. Using the lower estimate of costs per birth averted, one gets estimates of $238, $191, and $121, respectively.

39. The conclusions remain unchanged if the lower estimate of the costs per birth averted is used rather than the higher.

40. The cost of the materials alone is $17, which is high compared with approximately $2 a year for the oral contraceptive but almost identical to the five-year costs of injections. That cost has to be incurred up front, thus discouraging many programs.

41. These expenses cover universal primary education and public health expenditures per capita on the level of Sri Lanka and China.

42. Cochrane and Zachariah (1983) showed that reducing infant and child mortality was a more cost-effective way to reduce fertility than family planning in some very high mortality countries that had a low proportion of women wanting no more children. The data in that case applied to Kenya.

43. In Indonesia, for example, religious leaders have ruled that any irreversible change cannot be justified except on health grounds (World Bank 1990).

44. Johnson-Acsadi and Szykman (1980) and Ainsworth (1985) compiled data on the reason for nonuse of contraception for six and ten countries, respectively, from data from the late 1970s or early 1980s.

45. The data for Mexico were from 1978. It is interesting to note that once the government undertook support for family planning about that time, there was a rapid decline in fertility.

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